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Iodine intake and iodine status among lactating women and their children in the Saharawi refugee camps, Algeria.

Inger Aakre

Akershus University College
Faculty of Health, Nutrition and Management

HØGSKOLEN I AKERSHUS
AKERSHUS UNIVERSITY COLLEGE

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ABBREVATIONS AND DEFINITIONS

24H	24-hour
AUC	Akershus University College
BMI	Body Mass Index (kg/m^2)
BMIC	Breast Milk Iodine Concentration
CICH	Centre for International Child Health
DIT	Diiodthyrosine
ECHO	European Community Humanitarian Office
ENA	Emergency Nutrition Assessment
HRW	Human Rights Watch
I-	Iodide
I_2	Iodine
ICCIDD	International Council of Control of Iodine Deficiency Disorders
ICP-MS	Inductively Coupled Plasma - Mass Spectrometry method
IDD	Iodine-Deficiency Disorders
IHH	Iodine-Induced Hyperthyroidism
INRAN	National Institute for Research on Food and Nutrition
IO^-_3	Iodate
IOM	Food and Nutrition Board Institute of Medicine
IQR	Intra Quartile Range
MDM	Médicos Del Mundo
MIT	Monoiodothyrosine
NCA	Norwegian Church Aid
NGO	Non Governmental Organization
NIFES	National Institute of Nutrition and Seafood Research
NIRU	Nutritional Intervention Research Unit
NNR	Nordic Nutrition recommendations
PASW	Predictive Analytics SoftWare
REK	Regional Etisk Komite (regional ethical committee)
SCF	European Commissions' Scientific Committee on Food
SMH	Saharawi Ministry of Health
T_3	Triiodthyronine
T_4	Thyroxin
TG	Thyroglobulin
TPO	Thyroid peroxide
TRH	Thyrotrophin releasing hormone
TSH	Thyroid-stimulating hormone
UI	Urinary Iodine
UIC	Urinary Iodine Concentration
UNHCR	United Nations High Commissioner for Refugees
UNICEF	United Nations Children's Fund
WFP	World Food Program
WHO	World Health Organization

SUMMARY

Background: People in the long-term refugee camps in the Algerian desert are exposed to high iodine intakes from water and animal milk. At the same time the goitre rate is very high, with a goitre prevalence of 18 % for the women and 11 % for school age children.

Objectives: The main objective for this thesis was to examine iodine intake among lactating women, their iodine excretion in urine, and if high iodine intake for the women will give high level of iodine in breast-milk. And further how feeding practises and breast milk iodine concentrations is affecting the children's iodine concentration in urine.

Methods: 110 lactating women with their 110 children from 0 up to 7 months of age were included. The women's iodine intake was assessed by interviewed information of the last 24-hours and 7 days intake of iodine rich foods. To assess the iodine intake, samples of public water (n=24), camel milk (n=34) and goat milk (n=13) were collected from the women, as well as spot-urine and breast milk samples. Spot-urine was collected from the children as well as data on feeding practises. Iodine concentration in water and urine samples was determined by Sandell-Kolthoff reaction, whereas milk samples were determined by the Inductively Coupled Plasma-Mass Spectrometry method.

Results: Median (p25-p75) iodine concentrations of camel milk, goat milk and drinking water were 2020 (1502-4137) µg/L, 952 (801-1787) µg/ L and 102 (80-255) µg/L, respectively. Estimated dietary iodine intake for the women was 409 (234-709) µg/day, where water seemed to be the main contributor to the iodine intake. The women had a median urinary iodine concentration (UIC) of 349 (207-526) µg/L, and UIC were positively associated with BMI and camel milk iodine intake which explained 9,3% of the variation in UIC. The median breast milk iodine concentration (BMIC) was 479 (330-702) µg/L, and was positively associated with water- and goat milk iodine intake and UIC, which explained 15,8% of the variation in BMIC. Even though only 6% of the children were exclusively breast fed, no other foods or drinks but breast milk showed any association with the children's UIC. BMIC explained 9,9% of the variation in children's UIC. The children had a median urinary iodine concentration of 728 (401-1145) µg/L.

Conclusion: The median BMIC was generally higher than the median UIC and seemed to be affected more by dietary iodine intake than UIC. There are no upper levels of UIC or iodine intake for lactating women by the WHO. But 74 % of the women had iodine intakes above their daily recommended intake of 250 µg/day (WHO), indicating a high iodine exposure. The breast milk iodine concentrations were not favourable for children 0-7 months of age, which have a daily recommended intake of 90 µg/day (WHO). The children's urinary iodine concentrations indicate that the iodine intake from breast milk is very high, with 89% of the children having a urinary iodine concentration $\geq$ 300 µg/L, which is the upper limit used for an adult population (WHO). It is likely that the high iodine exposure may cause thyroid disorders for the women and their children.

1 Introduction

Iodine is an essential micronutrient for humans, and is important for metabolic functions, growth and development. Globally iodine deficiency is a big threat to people's health and development (World Health Organisation [WHO], 2007). But also too high intakes of iodine can lead to adverse health consequences (WHO, 2004b). The International Council of Control of Iodine Deficiency Disorders (ICCIDD) states that iodine excess carries some dose-dependent risks, and intakes over the recommended range should be avoided (Burgi, 2007).

Cross-sectional data from 1993-2003 showed that the iodine nutrition was optimal in 43 countries, and the number of countries with iodine deficiency as a public health problem had decreased from 110 to 53. At the same time 29 countries have shown to have iodine excess. The problem with iodine excess was most widespread in South and North America and Africa with 12 countries in the Americas and 7 in Africa with moderate high intakes. These same continents were also where the highest intakes were seen, with 2 African and 3 American countries showing intakes giving risk of adverse health consequences (WHO, 2004b). Thyroid diseases can be connected both to too low iodine intakes and too high (Laurberg, Pedersen, Knudsen, Ovesen & Andersen, 2001). Iodine deficiency can result in hypothyroidism[1], goitre[2], stillbirth and impaired growth and mental development (Hetzel, 1996). There is some evidence that too high iodine intakes may manifest itself in the same way as too low intakes (Markou, Georgopoulos, Kyriazopulou & Vagenakis, 2001; European Commissions' Scientific Committee on Food [SCF], 2002).

Overconsumption of iodine often come as a result of consumption of iodine-containing drugs, high intakes of iodised salt or foods naturally rich in iodine, like sea weed, marine fish, iodized water, sea-salt and iodide-containing dietary supplements (Burgi, 2007, 2010; SCF, 2002). The effect of chronically high exposure of iodine can result in disturbed thyroid gland activity. This may manifest itself either as goitre, as hypothyroidism with/without goitre, or as hyperthyroidism[3] (SCF, 2002).

[1] Insufficient thyroid hormone production (Hetzel, 1996).
[2] Enlargement of the thyroid gland (Hetzel, 1996).
[3] Excessive thyroid hormone production (Hetzel, 1996).

The main source of iodine for breastfeeding infants is the iodine found in human milk. The iodine content of breast milk varies with dietary iodine intake by the women. Adequate iodine nutrition is essential for children’s thyroid hormone stores, growth and development.
The consequences of excessive iodine intake for children are an area of little documentation, but iodine-induced hyper- and hypothyroidism may occur even in infants (Azizi & Smyth, 2009).

Refugees are a particularly vulnerable population group, also in the matter of nutrition, since they often are dependent of food aid and the quality of the food they receive. In the Saharawi refugee camps close to the city Tindouf in the southwest of Algeria lives about 165 000 refugees. They have been living there for 36 years since Morocco occupied their country in 1975, right after Spain withdraw its colonial power from the area (United Nations High Commissioner for Refugees [UNHCR], World food Programme [WFP] & Centre for International Child Health [CICH], 2002). For closer mention about the Western Sahara conflict see attachment 1.

After the occupation the majority of the Saharawi population lives in four refugee camps in Algeria named Smara, Auserd, Aaiun and Dajla. The area in which they live, the Sahara desert, is extremely harsh with almost no vegetation and extreme temperature changes. The Algerian government and the United Nations High Commissioner for Refugees (UNHCR) give necessary help to the refugees, while World Food Programme (WFP) and European Community Humanitarian Office (ECHO) are main donors of food (UNHCR et al., 2002). Nutrition studies in the camps have revealed severe nutritional problems, such as high prevalence of stunting and wasting among children less than 5 years and iron deficiency among women and children. There are also found obesity among women in fertile age (Saharawi Ministry of Health [SMH], Norwegian Church Aid [NCA], & Akershus University College [AUC], 2008; UNHCR et al., 2002; UNHCR, WFP & National Institute for Research on Food and Nutrition [INRAN], 2005; WFP & UNHCR, 2007).

In addition to the mentioned nutritional problems, there have been revealed high prevalence of goitre among the refugees. In 2002 UNCHR measured the prevalence of visible goitre among adolescents to be 7 % (UNHCR et al., 2002). A study from 2008 found the goitre prevalence among children (6-14 years) to be 11%, and the prevalence among the women was 18 %, measured by palpation. By palpation, a thyroid is considered goitres when each lateral lobe has a volume greater than the terminal phalanx of the thumbs of the subject being examined (WHO, 2007). The study also measured the size of the thyroid gland using ultrasonic equipment. Based on the international reference values for age (Zimmermann et al., 2004), totally 56% of the children had enlarged thyroid gland. Totally 22% of the women had enlarged thyroid volume using a cut-off value of 12.5 ml. One common method for examination of iodine status is to assess urinary iodine, where 90% of ingested iodine normally is excreted into urine (Zimmermann, 2008). The 2008 study found the median urinary excretion of iodine to be 565 µg/L for the children, and 466 µg/L for the women (SMH et al., 2008). According to WHO and ICCIDD a median iodine excretion in urine of ≥300 µg/L is excessive for an adult population, and may give risk of adverse health consequences (WHO, 2004b).

There is clearly a problem around excessive iodine intakes in the camps, and the previous reports show that the high prevalence of goitre probably is caused by high iodine intakes. But there are still uncertainties around the issue of excess iodine and its effects, both in the camps and generally. Different institutions have disagreement about the upper tolerable intake of iodine. And the effects on growth and development are not yet fully established. The area of excess intakes for infants and how this possible might affect them is also very little examined. In the camps there is no information about the iodine intakes of infants. Previous studies from other areas show that the excretion of iodine in breast milk is extremely variable, and are dependent of the iodine intake of the women (Azizi & Smyth, 2009; Semba & Delange, 2001). The content of iodine in breast milk of the women in the camps has not been examined before this study. Since the prevalence of goitre among both children and women in the camps is high, it is relevant to examine the excretion and content of iodine in breast milk, to be able to understand more about the iodine situation and the children's iodine intakes. The health authorities in the refugee camps have been asking for a study to examine problems of high iodine intakes more in detail, see attachment 2.

On request from the health authorities in the camps, an iodine study was therefore conducted in October- December 2010. The work that is described in this thesis was a part of a baseline of a cohort, among lactating women and their children in the Saharawi population in Algeria. The main goal of the cohort was to reveal the causes of the high iodine intakes among women, and see how this may affect the children. The children will be followed up in the years to come. This study has a cross-sectional design and involved measurement of urinary iodine, iodine content in breast milk, thyroid hormones in blood, analyses of iodine content in drinking water and animal milk, examination of iodine intake through diet interviews, mapping of demographic and socioeconomic status, and children's feeding practises. Akershus University College (AUC) directed the study in cooperation with the local health authorities; it was financed by the Norwegian Church Aid (NCA). The iodine study was conducted by two master students from AUC, with help from local fieldworkers and under local direction by the Ministry of Health in the refugee camps. The two master students, Inger Aakre and Navnit Kaur Grewal cooperated in the planning of the fieldwork and the collection of data. The respective theses have different research questions, and will draw on different aspects of the data collected in the study. In this thesis the iodine content in breast milk will be examined and how women's dietary intake and urinary excretion of iodine may be connected to this. Further this thesis will examine the feeding practises of children, and how this affects the children's urinary concentrations of iodine. The other master student will examine the women's iodine intakes and urinary iodine concentrations in comparison with thyroid hormones in blood.

1.1 *Background and context*

Three fourths of Western Sahara is occupied by Morocco, except a small area along the borders to Mauritania, which is controlled by the Saharawi liberation movement Front Polisario. Since the occupation the majority of the Saharawi population have been living in the four refugee camps in Algeria, near the city of Tindouf, see figure 1-1 (WFP & UNHCR, 2007). The refugee camps are now governed by Polisario, with assistance from the Algerian government and UNCHR (Human Rights Watch [HRW], 2008).

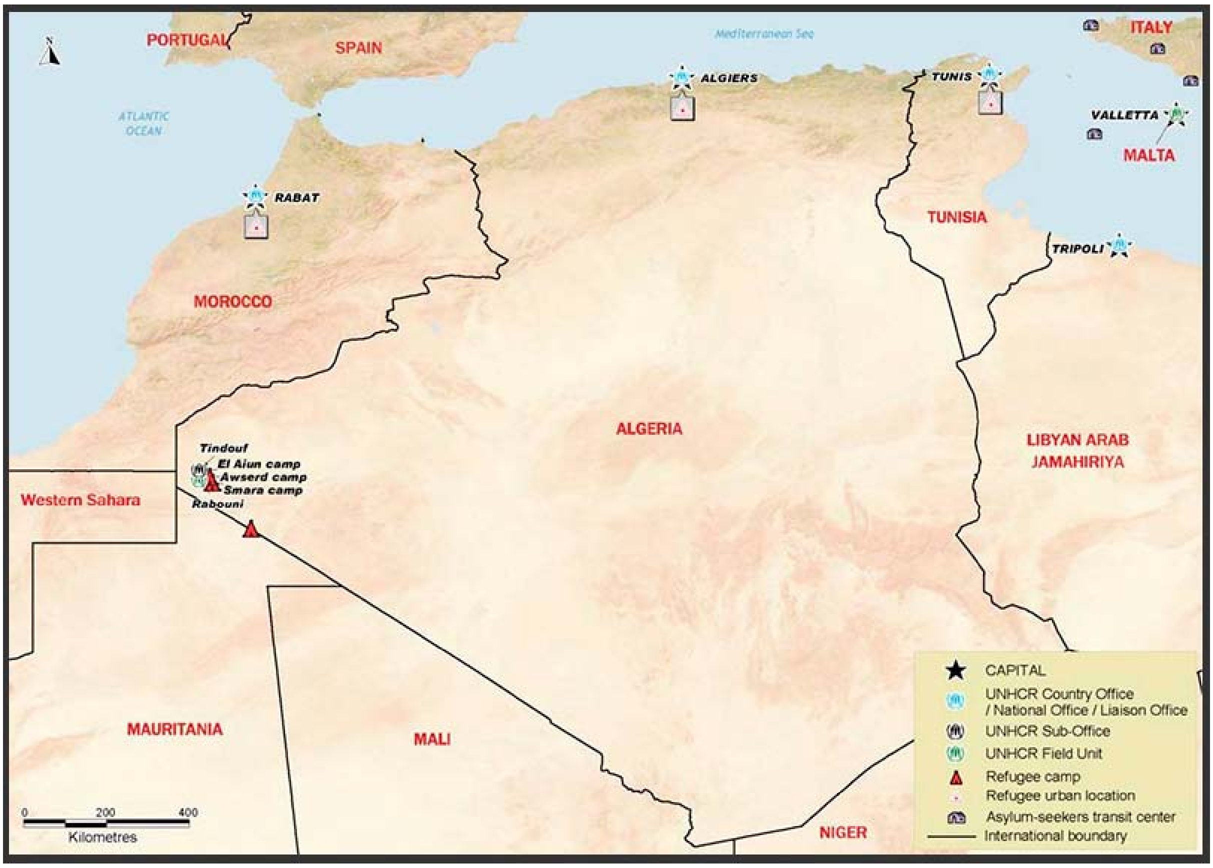
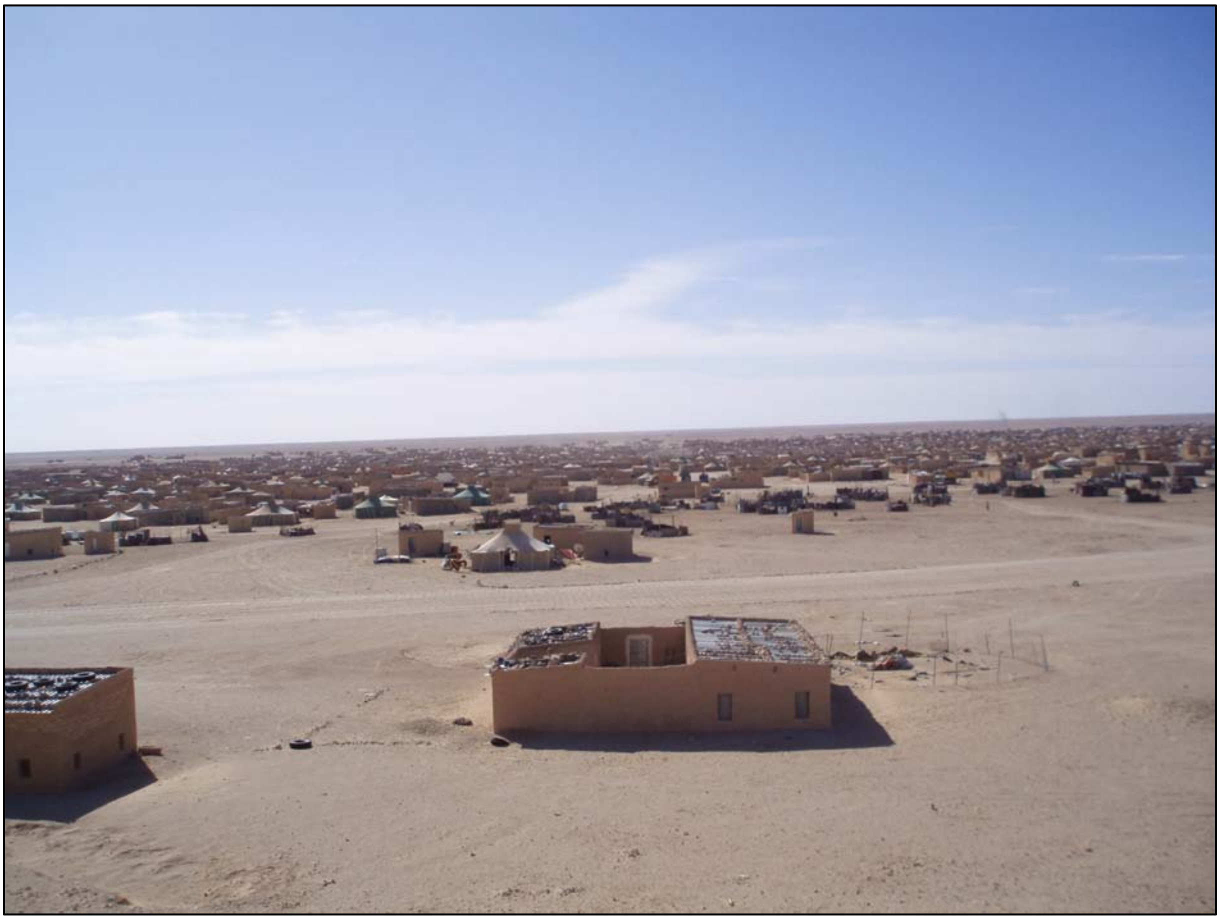


Figure 1-1 Map over Western Sahara territory and the Saharawi refugee camps ( ).

Source: (UNHCR, 2011).

The camps are located in the desert, within a range of a 3 hours' drive. The administrative organ of health in the camps is the Saharawi Ministry of Health, which is located in Raboni. Raboni is the administrative centre and lies in the middle of all the four camps. Each of the camps has a hospital who deals with minor complications, more severe cases is sent to the main hospital in Raboni, or to the city of Tindouf. Each camp is divided into 6-7 smaller districts. Each of the districts has its own local health administration with a public health centre. These local public health centres are conducting free health checks for pregnant women and babies, and in some cases also provide other medical and humanitarian services.

Social services such as schooling and basic hospital care are organized by the refugees themselves. Six years of schooling are guaranteed and obligatory for all children. After the obligatory school, many refugees travel to Algerian schools. Some pass into universities in Algeria, Cuba, Spain or other countries that provide scholarships for Saharawi students. Some job positions are offered by the miniseries, schools, health institutions and military in the camps, but jobs remain scarce and the Saharawis educated at universities abroad can rarely if ever find opportunities to use their skills in the camps. Most people therefore have little to occupy their time with (WFP, Medicos Del Mundo [MDM], NCA & AUC, 2008; WFP & UNHCR, 2007).



Picture 1-1 Overview of the refugee camp named Smara

The language among the Saharawi population is Hassanya, which is an Arabic sub-language. The children learn Spanish in school, and many adults also speak Spanish as a second language. The Saharawis are Muslims, and live after the Islamic principles (WFP & UNHCR, 2007). A study from 2005 found that the average family consisted of 6,5 persons, with 2 persons being the minimum and 15 being the most (NCA, AUC & SMH, 2005). The families in the camps live in tents, and most families also have a brick house built from sand. There is little electricity in the camps, and each family receive propane gas once a week from humanitarian aid, which is used for cocking purposes. Many families also have a solar cell panel where the electricity generated is mostly used for light inside the tent in the evenings (WFP & UNHCR, 2007).

The refugees are dependent of getting food from outside. Each family in the camps receive a food basket with basic foods from various donors (SMH et al., 2008). The main donor of the food basket is WFP, which gives wheat flour, corn soya blend, rice, oil, pulses and sugar. From UNHCR the refugees get yeast and tea, and from ECHO and different Non Governmental Organisations (NGO) pasta, fish, potato, onion, carrot and fruit have been given (WFP et al., 2008). In addition some families buy meat and milk. Previous studies show that many families buy fresh milk, either goat- or camel milk, for drinking. The origin of the goat milk is mostly within the camp, where some people are running small livestock. The origin of the camel milk is mostly the liberated area, but also sometimes within the camp (SMH et al., 2008; UNHCR et al., 2008). A report from 2008 showed that the main sources of iodine among the women was water (48% of intake) and local milk from either goat or camel (38 % of intake) (SMH et al., 2008). A study from 2011 show that the median iodine content in camel milk samples from the 4 camps were 2471 µg/L, and for the goat milk the median iodine content was 994µg/L (NCA & AUC, 2011), which is very high compared to the Word Health Organisations (WHO) daily recommended intake for adults at 150 µg/day (WHO, 2007). The highest median iodine content for goat milk were in samples from the camp Aaiun with 1866 µg/L, the highest median iodine content for camel milk were found in the milk reported to come from animals of the liberated area in the desert (NCA & AUC, 2011). The water conditions were also shown to be variable between the camps, since different wells supply the camps with water. The median iodine concentration of water from all of the camps were 108 µg/L, where Aaiun and Auserd had the highest content with 300 µg/L (Barikmo, Henjum, Dahl, Oshaug & Torheim, in press).

1.1.1 Main purpose

The main purpose for this project was to examine the iodine status among lactating women and their children aged 0-7 months, in the refugee camps in Algeria. The main objective for this specific thesis was to examine iodine intake and iodine status among lactating women, their breast milk iodine concentrations and how the breast milk iodine and feeding practises may affect the children's urinary iodine concentrations.

To examine the main objective, there were collected urine samples from the women and their children. Breast milk samples were collected from the women, and the women and children's iodine intake was assessed through diet interviews. Samples of drinking water and animal milk were collected, being the main sources of iodine in diet, to be able to assess the amount of iodine consumed by the women.

There will now follow a section of theory concerning iodine in human nutrition, assessment of iodine status, causes and consequences of iodine deficiency and excess, and iodine in breast milk. This section will lead to the specific objectives for this thesis. Following the objectives there will be a description of methods used, followed by result presentation and discussion.

2 Theoretical background

Chemically, iodine is the second least reactive of halogens, and the second most electropositive halogen. Iodine occurs in free state in nature only in trace amounts, when its oxidized by oxygen and other oxidants in the nature. It occurs in different chemical forms, such as iodate (IO^-_3), which is the most common form in the nature. When freed from other substances, it goes into form of diatomic molecules called iodine (I_2). In human nutrition, dietary iodine is absorbed as iodide (I^-) (Sharp, 2005).

2.1 Iodine in human nutrition

Iodine is an essential micronutrient for humans. It is a component in synthesizing the thyroid hormones, thyroxin (T_4) which contain 4 iodine atoms, and triiodthyronine (T_3) that contains 3 iodine atoms, which are important regulators of the metabolic rate and physical and mental development (Sharp, 2005).

Iodine is normally present in small amounts in soil, water, plants, animals and animal products in the nature (Semba, 2001). Concentrations of iodine in seawater are normally 50 µg/L, while freshwater normally contains < 15 µg/L (SCF, 2002). Iodine in certain sea-plants, fish and shellfish is therefore usually higher than for plants and animals living on land. The iodine content in soil, water and milk varies between geographical areas, and the content of iodine in the soil is often reflected in the concentration of iodine in drinking water. There are also a connection between soil rich in iodine and the iodine content in milk, if the animals are grazing in an iodine rich or poor area (Semba, 2001). The most common natural sources of iodine are therefore drinking-water and seafood. The content in plants and animal products depends on the environment in which they grow, but it is generally low (Sharp, 2005). It is common to have few sources and an inadequate intake of iodine, and in many countries iodized salt is the most important source to dietary iodine (Nordic Nutrition Recommendations [NNR], 2004).

Daily supply of iodine is needed to maintain an adequate production of thyroid hormones and to compensate for the small amounts excreted through saliva, sweat, faeces and tears (Sharp, 2005). UNICEF, ICCIDD and WHO recommend that the daily intake of iodine should be 90 µg/day for pre-school children 0-59 months, 120 µg/day for school children from 6-12 years, 150 µg/day for adolescents above 12 years and adults, and 250 µg/day for pregnant and lactating women (WHO, 2007). The Food and Nutrition Board of the Institute of Medicine

(IOM), in USA operate with slightly higher recommendations than the WHO (Food and Nutrition Board Institute of Medicine [IOM], 2001), see table 2-1.

Table 2-1 Recommended daily intake of iodine for different age or population

Age or population group	Recommended daily intake WHO (µg/day)	Age or population group	Recommended daily intake IOM (µg/day)
Children 0-59 months	90	Children 0-12 moths	110-130
Children 6-12 years	120	Children 1-8 years	90
Adolecents > 12 years	150	Children 9-13	120
Adults > 12 years	150	Adults > 14 years	150
Pregnancy	250	Pregnancy	220
Lactation	250	Lactation	290

Sources: (IOM, 2001; WHO, 2007).

The concerns around an upper limit or toxicity level of iodine vary between different institutions, table 2-2. The WHO operates with an upper limit of 300 µg/day for adults, and states that intakes above this may give risk of adverse health consequences (WHO, 2004b).The European Commissions' Scientific Committee on Food (SCF), established through a risk assessment report, a tolerable upper level of 600 µg/day for adults. This upper level is according to SCF also acceptable for pregnant and lactating women (SCF, 2002). The IOM have concluded that there are not seen any evidence for adverse physiologic reactions associated with iodine intakes up to 1100 µg/day for adults, pregnant and lactating women. For adults, pregnant and lactating women under 18 years the upper limit is 900 µg/day. For children 1-3 years of age the IOM operates with an upper level of 200 µg/day and 300 µg/day for children 4-8 years (IOM, 2001). There has not yet by any of these institutions been established an upper level for intake of iodine for children under one year.

Table 2-2 Tolerable upper level of iodine intake for different age and population

Age or population group	Upper level WHO (µg/day)	Upper level SCF (µg/day)	Upper level IOM (µg/day)
Children 1-3 years	—	200	200
Children 4-6 years	—	250	300
Children 7-12 years	—	300	300
Children 11-14 years	—	450	300
Adults > 14 years	300	500	900
Adults > 17 years	300	600	1100
Pregnancy	500	600	1100
Lactation	—	600	1100

Sources: (IOM, 2001; SCF, 2002; WHO, 2004b).

2.1.1 Absorption and transport

The body gets iodine from food and drinks in different chemical forms. The forms iodate and iodine gets reduced in the gut to iodide and is efficiently absorbed in the stomach and duodenum. Following absorption, free iodide appears circulating in the blood. In conditions of adequate iodine supply about 10% of the absorbed iodine is taken up by the thyroid gland. In chronic iodine deficient conditions the amount can be up to 80% (Zimmermann, 2009). Some amounts of the absorbed iodine are also accumulated by other tissues, like the salivary glands, choroid plexus and the lactating mammary gland. Uptake of iodide by all of these tissues is stimulated by the thyroid-stimulating hormone (TSH) that is released from the pituitary gland. When the iodine required for production of thyroid hormones have been met, the excess circulating iodide in the blood is transported to the kidneys and excreted in the urine. Urinary iodide is therefore a good indicator of the body's iodine status (Ristic-Medic et al., 2009; Zimmermann, 2009).

The human body contains about 15-20 mg of iodine, in healthy adults, where most is found in the thyroid gland. The thyroid gland must trap around 60 µg iodine per day in adults to maintain an adequate production of thyroid hormones (Zimmermann, 2009).

2.1.2 Synthesis and secretion of the thyroid hormones

The thyroid gland is one of the largest endocrine glands and is found right below the larynx. In an adult the thyroid weigh about 20-30 gram, and mainly consist of follicles. Each follicle consists of a single layer of epithelial cells surrounding an extracellular central space, called the inner colloidal space, which consists mainly of thyroglobulin (TG) which is a large glycoprotein and a storage form of thyroid hormones (Vander, Sherman & Luciano, 2001). The circulating iodide is taken up by the follicle cells of the thyroid, see figure 2-1. Uptake of iodide is received by a sodium-iodide symporter, which is an ion pump that transport iodide into the epithelial cells (Sharp, 2005). After this, it passes into the inner colloidal space and gets oxidized to iodine, by thyroid peroxides (TPO). The iodine reacts with the tyrosine, an amino acid, on the TG. Together they form monoiodothyrosine (MIT) and diiodthyrosine (DIT) (Sharp, 2005). These two precursors continue oxidation and couple to form the iodotyrosines T_3 and T_4. These remain bound to the TG, and are stored within the colloid until the thyroid is stimulated by thyroids stimulating hormone (TSH). When stimulated by TSH, TG gets absorbed by the follicle cells, and T_3 and T_4 is enzymatically released from TG and into the circulation. T_3 is about ten times more biologically active than T_4, but around

90% of the thyroid hormones secreted from the thyroid gland are T_4. In the circulation, enzymes can convert T_4 to T_3, so when the dietary intake of iodine is insufficient the level of T_4 in the blood falls (Vanderpas, 2006).

TSH stimulates increased iodine uptake, synthesis and secretion of T_3 and $T_{4,}$ it also stimulates the growth of the thyroids gland. TSH affluence the follicle cells by binding to receptors in the cell membrane, this affects the activity and number of the cells (Vanderpas, 2006). Secretion of TSH is regulated by the circulating thyroxin (T_4) and also by thyrotrophin releasing hormone (TRH) secreted by the hypothalamus. The TRH release is influenced by neurotransmitters such as adrenalin, noradrenalin, serotonin and dopamine (Semba, 2001). The thyroid gland and the hypothalamus together therefore have a negative feedback mechanism. When the TSH hormone is released, the thyroid hormones T3 and T4 gets quickly released into the circulation, and increases iodine uptake by the thyroid gland. This increased level of thyroid hormones inhibits further excretion of TSH (Semba, 2001; Vanderpas, 2006).

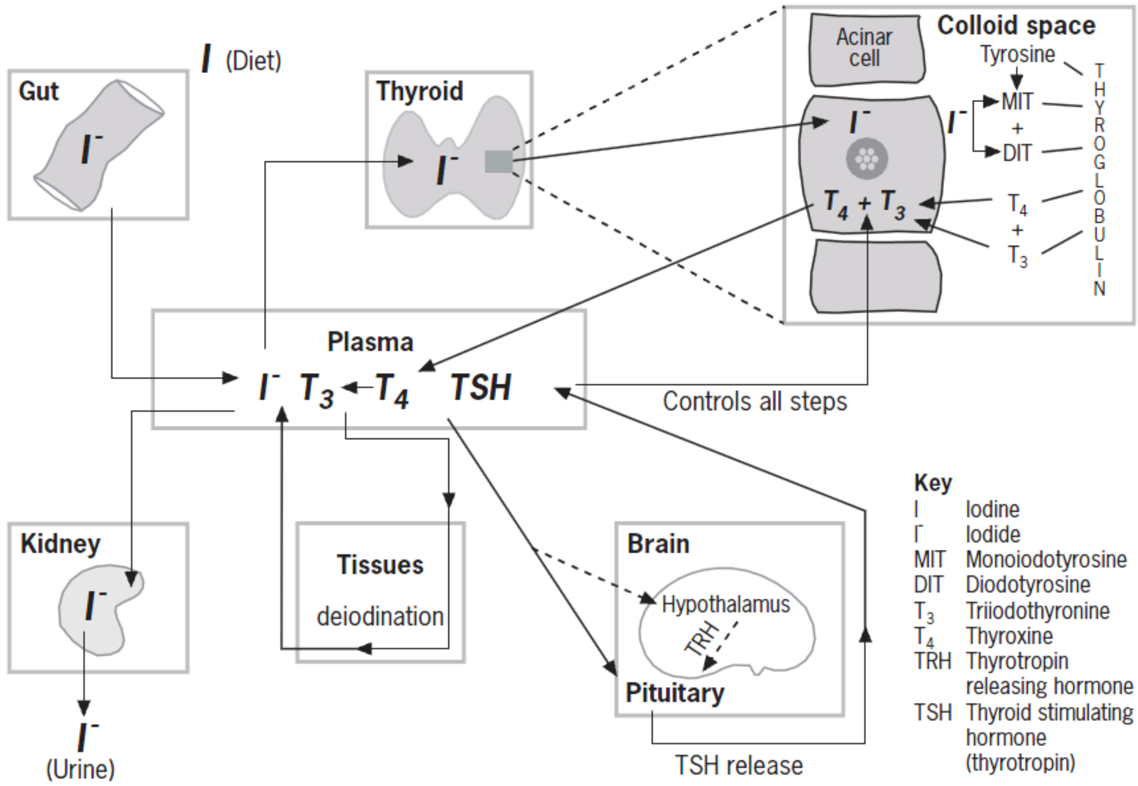


Figure 2-1 Thyroid hormone synthesis and secretion. Source: (WHO, 1998).

2.2 Biological functions of iodine

As a necessary component in the thyroid hormones, iodine is an important mineral. The thyroid hormones regulate the metabolic processes of the body, and are very important for physical and mental development (Sharp, 2005).

2.2.1 Metabolism

The thyroid hormones are prime regulators of the basal metabolic rate, and have major effects on the metabolism of carbohydrates, proteins and lipids. Much of this regulation goes through regulation of physiological activities, like hart rate, oxygen consumption, respiration which again affects the energy requirements (Semba, 2001). But the metabolic regulation by the thyroid hormones also occurs through modulation of gene transcription, which can affect cellular nutrient uptake and metabolism (Moeller, Cao, Dumitresch, Seo & Refetoff, 2006).

2.2.2 Growth and development

The synthesis of growth hormones is partly regulated by circulating thyroid hormones, and they also play a role in normal bone cell growth and development. Thyroid hormones are involved in the early growth and cell differentiation of the brain and nervous system in fetus. They are therefore crucial for normal brain development for children (Semba, 2001).

The thyroid hormones also have a number of other functions in the body. They are among other things contributing in the transformation of carotenoids to metabolic active vitamin A and increase the impact of the sympatric nervous system, probably by increasing the number of receptors of adrenaline and noradrenalin. Normal production of thyroid hormones is also important for normal gonad function in both women and men, and an insufficient thyroid hormone production can lead to loss of menstruation, reduced sperm production and infertility (De Groot, Larsen & Hennemann, 1996; Semba, 2001).

2.3 Assessment of iodine status

Four indicators are generally used to measure iodine status in a population; urinary iodine concentrations (UIC), the goitre rate, serum TSH and serum TG. School age children (6-12 years) are recommended by WHO as a reference group for measuring iodine status in a population (WHO, 2007). Of the mentioned four indicators, only UIC will be mentioned here, since this is the only indicator used in this thesis.

2.3.1 Urinary iodine concentrations

UIC is a reliable biomarker of iodine status (Ristic-Medic et al., 2009; Semba, 2001). About 90% of the dietary iodine appears in the urine, and UIC is therefore a good indicator of recent iodine intake, and reflects the iodine intake over the last 24 hours in a population (Zimmermann, 2009).

Iodine deficiency is considered a public health problem if the median iodine excretion in urine is below 100 µg/L, among school children. If the urinary excretion is above 300 µg/L in school-aged-children, the WHO considers it excessive (WHO, 2004b). The WHO sets an UIC < 100 as insufficient for children below 2 years, and an UIC ≥100 as adequate. For lactating women the same cut-offs are used, where UIC < 100 is considered insufficient and UIC ≥100 is considered adequate (WHO, 2007), see table 2-3.

Table 2-3 Epidemiological criteria for assessing iodine nutrition based on median UIC in population groups, by WHO

Median UI (µg/L)	Iodine intake	Iodine nutrition
School-age children		
< 20	Insufficient	Severe iodine deficiency
20-49	Insufficient	Moderate iodine deficiency
50-99	Insufficient	Mild iodine deficiency
100-199	Adequate	Optimal iodine nutrition
200-299	More than adequate	Risk of iodine-induced hyperthyroidism within 5-10 years
≥ 300	Excessive	Risk of adverse health consequences
Pregnant women		
< 150	Insufficient	
150-249	Adequate	
250-499	More than adequate	
≥ 500	Excessive	
Lactating women		
< 100	Insufficient	
≥ 100	Adequate	
Children< 2 years		
< 100	Insufficient	
≥ 100	Adequate	

Source: (WHO, 2004b; WHO, 2007).

2.4 *Thyroid disorders*

In order to understand the problems and consequences of iodine excess, the pathological consequences of iodine deficiency needs to be mentioned. There is limited research of the pathological consequences of chronically high exposure of iodine, but there are some evidence pointing out that in some cases the consequences can be the same as for iodine deficiency (Markou et al., 2001).

2.4.1 Iodine deficiency

Iodine deficiency has many adverse effects on growth and development in humans. These effects are collectively termed iodine-deficiency disorders (IDD). IDD are a result of an inadequate thyroid hormone production due to insufficient iodine intake (Zimmermann, Jooste & Pandav, 2008). The main cause of iodine deficiency is low concentrations of iodine in the soil, and with that little iodine in water, milk and locally grown food. Severe iodine deficiency is most common in developing countries where the soil contains small amounts of iodine, and the diet is mostly based on local foods (Semba, 2001).

2.4.2 Iodine deficiency disorders

The pathological consequences of iodine deficiency include endemic goitre, endemic cretinism, damage to fetus, increased stillbirths and increased prevalence of different cognitive motor handicaps (WHO, 2007). Insufficient iodine lowers the production and availability of thyroid hormones, which gives hypothyroidism. The extent of the clinical manifestations depends of the severity of the iodine deficiency, and how the individual adapt to it (Hetzel, 1996).

Endemic goitre, hyper- and hypothyreosis

The first clinical manifestation of iodine deficiency is thyroid enlargement or goitre. Because the thyroid gland is deficient of iodine, it has failed to meet the required level of thyroid hormone production. Like a muscle, the thyroids response to the increased demand of thyroid hormones is hyperplasia- an enlargement of tissue caused by an increased number of cells. Often this adaption is sufficient to maintain an adequate thyroid hormone production (Hetzel, 1996).

A long standing hyperplasia eventually leads to nodularity, including autonomous nodules that may produce excessive thyroid hormones and make the subject hyperthyroid. If the adaptive mechanisms not meet the challenge of iodine deficiency, the thyroid hormone production will be insufficient and the subject will become hypothyroid (Dunn, 2000).

Growth and development

Hypothyroidism from iodine deficiency is a very serious condition, especially for pregnant women, because of the damage it may cause on the fetus. Adequate thyroid hormone is essential for proper development of the central nervous system for the fetus and young infants. The effect on fetus and infants can be an underdeveloped brain and mental and physical retardation (Dunn, 2000).

Endemic cretinism

Severe iodine deficiency during early human development can produce cretinism. Cretinism is a condition of severe mental retardation and a number of manifestations related to neurological functions. Two types of cretinism exist; neurological and myxedematous. In addition to the retardation, the first type also may have varying degrees of deaf mutism and walking disturbances, where the last type can have hypothyroidism and severe growth retardation (Dunn, 2000).

Reproductively and child mortality

Iodine deficiency also causes reproductive loss and decreased infant survival. A high incidence of spontaneous abortion has been reported from areas with iodine deficiency, while correction of the iodine deficiency among pregnant women was shown to reduce the infant mortality and abortions (Dunn, 2000). In increased incidence of infant mortality have been associated with goitre during pregnancy, and studies from different parts of the world show that iodine supplements before and during pregnancy reduces stillbirths and infant mortality (Semba, 2001).

2.4.3 Excess of iodine

The synthesis and secretion of thyroid hormones has many regulatory mechanisms with the purpose of maintaining an adequate hormone level in the blood, in the cases of both iodine deficiency and excess. Despite all these mechanisms thyroid dysfunction is still occurring (Burgi, 2010). Iodine deficiency is associated with disturbances in thyroid function. Similar, iodine excess has also been shown to impair the thyroid function. Iodine excess is occurring more frequently, especially when salt iodine concentrations are too high or are poorly monitored (Andersson, de Beinost & Rogers, 2010). Iodine's influence on the thyroid gland is complex with a U-shaped relation, where both too low and too high intakes can give thyroid dysfunctions (Burgi, 2010; Seal, Creeke, Gnat, Abdalla & Mirghani, 2005).

Acute iodine excess

Both acute and chronically iodine excess may occur. Acute iodine excess may be caused by radiographic contrast media, or intake of seaweed or iodine containing drugs (Burgi, 2010; Dunn, 2000). Acute iodine poisoning caused by ingestion of many grams iodine may cause gastrointestinal irritation, abdominal pain, nausea, vomiting, and diarrhoea. Most iodine-sufficient people can handle a large amount of iodine in a short period without significant effect, and healthy adults are tolerant to 1 mg/day because of the thyroids capacity to adjust to a wide spectre of intakes. An exception is areas of iodine deficiency, where many people have autonomous nodules as a result of iodine deficiency. The thyroid hormone synthesis in such nodules is unregulated, and an excess intake can cause overproduction of thyroid hormones and cause hyperthyroidism (Dunn, 2000).

Chronically iodine excess

Chronically high iodine exposure may occur by unintentional high salt iodization, too high intake of salt, too high intake of iodine containing dietary supplements or consumption of iodine containing drugs or foods naturally rich in iodine. These foods can be sea weed, marine fish, ground beef containing thyroid tissue, water, milk and sea-salt (Barikmo et al., in press; Burgi, 2007; NCA & AUC, 2011; SCF, 2002). The effects of chronically high exposure of iodine can result in disturbed thyroid gland activity. This may manifest itself either as goitre, iodine-induced hypothyroidism with or without goitre, iodine-induced hyperthyroidism (Burgi, 2010; SCF, 2002). Much circumstantial evidence links excessive iodine intake with the risk of increased incidence of autoimmune thyroiditis, an inflammation of the thyroid gland, but environmental contaminants may also play a part (Sandström, 1998).

2.4.4 Iodine induced thyroid dysfunction

Excessive iodine intake may result in thyroid dysfunction in certain persons. Coident described the first case of iodine induced hyperthyroidism already in 1821 (Frandkin & Wolff, 1983), while the first case of hypothyroidism caused by iodine excess was described in 1945 (Hurxthal, 1945).

Hyperthyroidism is a condition of increased metabolic rate, because the thyroid gland produces too much thyroid hormone. This may cause afflictions like tremors, increased hart rate, uneasiness and weight loss (Dunn, 2000). Iodine-induced hyperthyroidism (IIH) is most common in areas of previous iodine deficiency. This is because subjects may develop autonomous nodules in iodine deficient areas, as a response to the lack of iodine. The autonomous nodules escape from TSH control, and when introduced to enough iodine these nodules produce excess thyroid hormones and the subject becomes hyperthyroid. This type of IIH may occur already at intakes below 300 µg/day (Nelson & Phillips, 1985; Todd et al., 1995). This nodular goitre will disappear slowly after iodine supplementation, and the condition of hyperthyroidism decreases over the years (Lewinski et al., 2009). Autonomous nodules may not be the only cause and explanation of IIH. Denmark, as a moderate iodine-deficient country, introduced iodization of salt in 1998 to prevent goitre. After 6 years the overall incidence rate of hyperthyroidism increased, and the increase was highest in the young population groups, where nodules goitre is rare (Bülow Pedersen et al., 2006).

In the case of hypothyroidism, the thyroid gland produces an insufficient amount of thyroid hormones. The manifestations of hypothyroidism may be fatigue, somnolence, weight gain and cold intolerance. Prolonged hypothyroidism may lead to irreversible atherosclerosis and hypertension (Dunn, 2000). The Wolff-Chaikoff effect, is a compensatory mechanism of the thyroid gland in the situation of iodine excess. The thyroid inhibits the organification (oxidation) of iodine inside the follicle cells, which is one of the first steps in thyroid hormone synthesis. The Wolff-Chaikoff effect inhibits large quantities of thyroid hormones into the blood stream. This leads to short-term hypothyroidism (Markou et al., 2001). This condition normally passes after a few days, through a so-called escape phenomenon and the thyroid hormone synthesis returns to normal. However, cases of hypothyroidism can be developed. New borne and fetus, and patients with autoimmune thyroiditis[4] are subjects who are predisposed for iodine-induced hypothyroidism (Glinoer et al., 1995; Markou et al., 2001). If excess intake occurs during pregnancy, the foetal thyroid is unable to escape the Wolff-Charkoff effect. The new-born therefore can develop goitre, become hypothyroid and may suffer possible tracheal compression (Glinoer et al., 1995).

Both hypo-and hyper thyroidism may give an enlargement in the thyroid gland, goitre. An enlargement of the thyroid is often harmless, but a large goitre may cause compression on the

[4] Thyroiditis is a group of disorders that all cause thyroidal inflammation.

trachea and oesophagus (Hetzel, 1996). The main damage of excessive iodine intake would be an increase in the incidence of autoimmune thyrioditis and hypothyroidism (Teng et al., 2006). Hypothyroidism has severe health consequences; the condition may occur by iodine excess and will appear the same way as in the case of iodine deficiency (Markou et al., 2001), having impacts on growth and development of children, reproductively and child mortality (Dunn, 2000).

2.4.5 Iodine excess in children

Infants can be exposed to excess iodine indirectly by the mother's high iodine intake, both during pregnancy and while lactating. Excess iodine exposure during pregnancy may influence the foetal thyroid hormone metabolism and result in foetal or infant hypothyroidism or hyperthyroidism (Sun & Yang, 2009). Thyroid hormones are important for growth and development. The infant need adequate supply of iodine for normal thyroid activity, which is vital for brain development during the first two years of life (Etling, Padovani, Forque & Tato, 1986). The possible adverse effects of excess iodine on skeletal growth are an area of limited data, but recent studies imply that there might be a connection (Sun & Yang, 2009).

2.5 Iodine in breast milk

WHO recommends children up to 6 months of age to be exclusively breast fed (WHO, 2002). Summarised studies from well nourished populations in both developed and developing countries show that mean breast milk intake of exclusively breastfed infants, reared under favourable environmental conditions increases gradually throughout infancy. At one month age the mean breast milk intake was estimated to be 699 g/day, and at 6 months age the mean intake was increased to 854 g/day (WHO, 2002). The quantity of breast milk secreted may vary from 500 mL/day to over 1000 mL/day (Picciano, 2000).

Iodine in breast milk responds quickly to dietary iodine intake, both consumed as supplements or through natural foods (Dorea, 2002). The mammary gland is able to absorb and concentrate iodine during pregnancy and lactation, this mechanism seemingly ensures supply of iodine to the new born. This happens by the expression of the sodium-iodine symporter, who is up regulated in the lactating mammary gland which results in increased uptake of iodine. The loss of iodine in breast milk causes the increase in dietary iodine requirements for lactating women (Semba & Delange, 2001).

In the area of Western Sahara, the refugee women and children have alarmingly high goitre prevalence; at the same time as the iodine intake have been found to be high. This study's purpose was to find the connection between the women's iodine intake, UIC and breast milk iodine concentration, and the iodine intake of their infants, to explore and monitor the iodine situation in the camps.

3 Objectives

This project was carried out by two master students. The main objective for the project was to examine the iodine status among lactating women and their children aged 0-7 months, in the refugee camps of Tindouf.

The main objective for this thesis was to examine lactating women's iodine intake, its influence on breast milk and urine, and how breast milk iodine and feeding practises may affect the children's urinary iodine concentration.

Specific objectives for this thesis:

1. *Assess the iodine content in:*
   - water
   - animal milk
   - breast milk
   - women's urine
   - children's urine

2. *Analyse factors that may influence on:*
   - breast milk iodine content
   - urinary iodine for women
   - urinary iodine for children

3. *Analyse if there are differences in:*
   - urinary iodine concentrations, breast milk iodine concentrations and iodine intake for women in different areas
   - urinary iodine concentrations, iodine intake and feeding practises for children in different areas

4 Sample and methods

4.1 Sample

In 2002 UNHCR calculated the whole population in the refugee camps to be approximately 165 000 (UNHCR et al, 2002). In 2006, after a discussion about the size of the refugee population, Polisario and the Red Crescent came to an agreement with the UN that the number of vulnerable refugees, meaning that they were entitled aid, was stipulated to be 124 960. When calculating the sample size this number was used as the target population (for the document with the population number, see attachment 3). There were no lists available over women which recently had given birth.

4.1.1 Sample size

The study was conducted on a sample of lactating women with children 0-7 months in the four camps in total. This thesis was a part of a project, and the sample was calculated from the goitre prevalence among the women in the camps which was 18% (SMH et al., 2008), to be able to explore consequences of excessive iodine intakes. The sample size was calculated by the software Epi Info statcalc, using a statistical power of 80% and a 5% margin of error ("Eip Info", 2011). There were added 10% to the calculated sample to, and the final sample consisted of 110 women and 110 children.

It was desired that each of the camps were to be represented in the sample. Therefore the list with population numbers from Polisario, Red Crescent and United Nations was used to calculate the number of participants needed from each camp, to assure that all the four camps would be represented, see attachment 4 for calculation of participants needed from each camp. There were needed 39 women with children from Smara, 25 from Auserd, 15 from Dajla and 31 from Aaiun. The population list was also used to calculate the number needed from each of the districts within each camp.

4.1.2 Sample procedure

There was no lists available to draw participants from. The selection procedure of participants was done by the head of each of the local health stations and the health director drove around and asked lactating women with children in the target age if they wanted to participate in the study. This was done until the aquired sample size was met in each district. Those who wanted to participate were told to meet at the local health station at a certain time. When the women arrived the health station they were again asked by the project workers if they wanted to participate, and were informed more closely about the study. They were given a consent letter with information about the study. If they said yes to participate, they were asked about the age of their baby and if they were lactating. The women who matched these inclusion criteria's have participated in the study. In most of the districts the exact number needed were selected by the head of the local health station. If there were selected more women than needed, the ones who came first and met the inclusion criteria's were included. In the situations where the women did not meet the inclusion criteria's or did not want to participate for some reason, the head of the health station went out to select more women. Seven of the districts were not able to meet the calculated number of participants; therefore it was necessary to recruit some extra participants in other districts to meet the required sample size in each camp.. Each of the districts in each camp is represented in the study.

4.2 Ethical considerations

An application was sent to the Regional committee for medical and health professional research ethics, department East-Norway, (Regional komitè for medisinsk og helsefaglig forskningsetikk, REK) in advance of the fieldwork. For the approval letter from REK, see attachment 5. An enquiry was also sent to the Saharawi Ministry of Health, asking for permission and support of the study. Approval letter from the Saharawi Ministry of Health is found in attachment 2.

Before including the women in the study, they were given information about the study through a consent letter that they had to sign, for the consent letter see attachment 6. Many of the women were illiterate and therefore the local fieldworkers were trained to read the letter to them. The letter informed the participants of the purpose of the study, what they needed to contribute with and that is was voluntarily. The women were also informed that they at any time could resign from the study without giving any reason. They were informed that the information and data would be confidential, but that the personal data would be used to find back to them after two years for the follow-up study, or to find back to them if any of the results from the samples showed that they needed treatment. The women were informed on behalf of their children. The slip where the women signed the letter were cut off from the rest of the letter and kept by the project leaders. The rest of the letter, with the information was given to the women to keep. No reward was given to the participants.

4.3 Data needed and methodical objectives

To be able to answer the research objectives, different data was needed to be collected in field. The methodical objectives were:

From 110 women:

1. Collect urine samples
2. Collect breast-milk samples
3. Collect animal milk and water samples
4. Collect data about iodine intake for the women
5. Collect data about the children's breast-feeding and general feeding practices
6. Do anthropometrical measurements

From 110 children from 0-7 months

7. Collect urine samples
8. Do anthropometrical measurements

4.4 Preparations before leaving

To achieve the data needed and the methodical objectives, much preparation had to be done before leaving Norway. The following section explains more about this.

4.4.1 Developing questionnaires

Four questionnaires were developed by the two students in advance of the fieldwork, to collect information from the participants. Questionnaire 1 was called "background information", (see attachent 7). Questionnaire 2 was called "breastfeeding practises", (see attachment 8), Questionnaire 3 was called "iodine intake women", (see attachment 9), and questionnaire number 4 was called "samples and measurements", (see attachment 10). All of the questionnaires contained a pre-section where the date was noted, id-number of the woman and child, which camp and local health station they belonged to, and the name of the interviewer. The interviewer also wrote down the time when the interview started and ended. For missing data the values 97, 98, 99 were used, meaning respectively "interviewer forgot to ask", "have not answered" and "don't know". In the categorical questions that required so, an open question was added for the purpose of writing down a category not included in the question.

Questionnaire 1

The first questionnaire, background information, contained background questions about the woman's situation and living conditions. The questionnaire was developed from a previous questionnaire used in the camps in the iodine study in 2008 (SMH et al., 2008), which was given some modifications by the students to fit in this study. An overview of the variables used is found in table 4-1.

Table 4-1 Overview of variables in questionnaire 1

Categorical variables	Continuous variables
Civil status	Age
Lived in other camp before	People living in household
Lived in other area outside the camp	Age of head of household
Education level	Number of children alive and dead
Courses taken	Number of children under 5 years
Languages spoken	
Work situation	
Gender of head of household	

Developing the food assessment questions in questionnaire 2 and 3

Both questionnaire 2 and 3 contained questions about intake of food and drinks. For the women the food intake questions dealt with foodstuffs known to contain iodine. The children's food intake questions dealt with breast feeding practises and frequency, and also general feeding practises.

There are two types of methods that are used to assess intake of foods or specific groups of food. The first is type is daily consumption methods that use recalls of food consumed over a one day period. This method is called 24 hour recall (24H recall), and interviewing techniques are used to recall the subjects exact food intake over the previous 24 hour period. This method can use portion size estimates to calculate energy and/or nutrient intake, and there is also possible to register the recalled amount of food on a scale. The second method, called food frequency, uses a longer retrospective history, and assess the frequency of food types or food groups consumed over a specified period of time. This method aims at estimating food patterns, energy intakes and some nutrient intakes, and exact amount of food eaten is usually not registered, but may be (Gibson, 2005a). In questionnaire 2 and 3 a combination of these two methods were used.

In questionnaire 2, frequency questions of a period of one week and the last 24 hours were used to examine the children’s intake of foods and drinks other than breast milk. For each food and drink listed there was a question of times given yesterday and times given the last week. Specific amounts were not taken, only food / drink type and frequency.
In questionnaire 3 the women’s iodine intake was examined through recall questions of a seven day period. The exact amount of the specific food/drink was measured for each day of the previous week. The day of yesterday was used as a 24H recall. Both questionnaire 2 and 3 contained a short information note for the field workers to read for the women, defining what was meant by the term last 24 hours and last week.

Questionnaire 2

Questionnaire 2, breastfeeding practises, was developed on the basis of WHO and UNICEFs child feeding practises (WHO & UNICEF, 2007, 2010a, 2010b). In addition to questions about breastfeeding practises, there were also made frequency questions of the water, milk and foods given the child. These questions were made of the experiences in other surveys, showing that even very small children are often given other foods and drinks but breast milk (UNHCR et al., 2005; WFP et al., 2008). The foods and drinks were important to detect in order to know the influences on the iodine intake by the children. The different types of drinks and food that was possible to give were all listed to help the women remember. The breastfeeding practises questionnaire also contained some background information about the child, and questions about illness during the last two weeks. See table 4-2 for an overview of all the variables used.

Table 4-2 Overview of variables in questionnaire 2

Categorical variables	Continuous variables
Gender of child	Age of child
Birth date	Childs weight and height
Birth place	How many times women was breast feeding the last day and night
Diarrhoea and other diseases the last 2 weeks	How many times the child was given other foods and drinks yesterday and last week, origin of the milk and water given and if it was boiled
If the times breast fed the last day and night were normal, and if no why not	Age of child when it first was introduced to solid or semi-solid food
Medicine given the last 2 weeks	Age of child when the women plan to stop breast feeding
Time after birth the women started breast feeding	
Food/ drinks given before breastfeeding the first time, the origin of the milk and water given and if they were boiled	
If the women ate like normal when pregnant with the child	
Did the women go to health controls when pregnant with the child	
How the women breast feeds her child	

Questionnaire 3

The third questionnaire, iodine intake women, contained questions of the amounts foods/ drinks known to contain large amounts of iodine that were consumed in the camps. These were water and milk (SMH et al., 2008; WFP et al., 2008). The women were asked about the amount of camel milk, goat milk, candia milk, powder milk, water and water for tea and soup. A previous study (SMH et al., 2008) showed that the practise in the camps was to mix the milk with water before drinking it; therefore the questions about milk also contained a question to detect the mixture ratio between water and milk. The questionnaire also contained questions about what kind of water and milk that was used and the origin of the milk. A question about soup was also included in the questionnaire, but foods like rice and lentils even though they absorb water when boiled, were let out. The variables in questionnaire 3 are found in table 4-3.

Table 4-3 Overview of variables in questionnaire 3

Categorical variables	Continuous variables
Origin of the milk types, water tea and soup	Amount of different types of milk, water, tea and soup drunken the last week
Was the amount of milk, water, tea and soup drunken the last week the same as a normal week	Mixture rate between water and milk

Questionnaire 4

The fourth questionnaire, samples and measurements, was to use only by the fieldworkers to note down the anthropometrical measures, if all the samples were taken and the origin of the milk and water samples.

4.4.2 Protocol

Before leaving Norway a protocol was developed by the students, to give to the fieldworkers and other collaborators in the refugee camps. The protocol contained a short and relatively simple overview of the purpose of the study, the goals and how to collect the different types of data. See attachment 11. The protocol was also translated into Spanish, see attachment 12.

4.4.3 Equipment

To collect the biological samples, equipment were bought for urine-, breast milk-, animal milk- and water samples. The equipment was bought from the supplier of medical equipment Med-kjemi, in Norway. Other equipment needed was also gained, such as breast pumps, scales, cooling bags, pens, paper etc. There were needed a permission to get the medical equipment into Alger, which were handled by the Polisarian contact in Alger. An application with a list of the equipment was sent to the Polisarian represent in Alger, who forwarded it and got it approved by customs authorities in Alger.

4.5 Preparations in field

After arrival in the camps, there were 2 weeks set aside for preparations. This time was used to go through equipment, further development of study performance, translate the questionnaires into Spanish, translate the consent letter into both Spanish and Arabic, meet with all the persons included in the team and train the local fieldworkers. During the period of training, the local fieldworkers came with some suggestions for changes in the questionnaires and work schedule, and some changes where done. The questionnaires and the concent letter were translated by a translator in discussion with the local fieldworkers and the students. The Spanish questionnaires are found in attachment 13-16. The consent letter in Spanish isfound in attachment 17 and in Arabic in attachment 18. The work schedule is found in attachment 19.

4.5.1 Training of field workers

Two local fieldworkers, and two local bio-engineers, were recruited by the health director from the Saharawi ministry of health. The local fieldworkers were educated as nutritionists;

which are local health workers who have been trained to do nutrition work in the camps by NCAs nutrition project. The team consisted further of a doctor as a medical contact, and a translator.

There were used 6 days for training of the two fieldworkers included a one day pilot study. The whole team, included the health director, the doctor and the bio-engineers was present the first day of the training, to be informed about the study, time table and to be able to give feedback. The bio-engineers had a short training session and got familiar with the equipment the first day. The training was conducted in a conference room in the ministry of health and 2 days in the hospital in Auserd. The rest of the week was used to train the local fieldworkers. The two students, the supervisor and a translator were present under the training together with the two fieldworkers. Table 4-4 show an overview over the training and preparations that was done the week before the study.

Table 4-4 Training of the local fieldworkers and preparations

Date	Persons included	Training arrangement
Saturday 23.10.10	Health director, the two local fieldworkers, doctor, the two local bio-engeneers, translator, Navnit Kaur Grewal, Ingrid Barikmo, Inger Aakre.	Meet with all the parts included in the study. Present the study for everyone, and show the equipment. Train the blood sample personnel.
Sunday 24.10.10	The two local fieldworkers, translator, Navnit, Ingrid, Inger.	Go through the study in details. Translate and go through the consent letter. Translate and go through questionnaire 1.
Monday 25.10.10	The two local fieldworkers, translator, Navnit, Ingrid, Inger.	Translate and go through questionnaire 3. Practical training in using questionnaire 1 and 3. Go through anthropometrical measures.
Tuesday 26.10.10	Translator, Navnit, Ingrid, Inger	Translate questionnaire 2. Translate the consent letter into Arabic.
Wednesday 27.10.20	The two local fieldworkers, translator, Navnit, Ingrid, Inger.	Go through and have practical training with questionnaire 2. Practical training of all the tasks that is needed to be done from start until end in a household.
Thursday 28.10.10	The two local fieldworkers, translator, Navnit, Ingrid, Inger.	Time off
Friday 29.10.10	The two local fieldworkers, translator, Navnit, Ingrid, Inger.	Time off
Saturday 30.10.10	Health director, the two local fieldworkers, the two local bio-engeneers, translator, Navnit Kaur Grewal, Ingrid Barikmo, Inger Aakre.	Pilot study

4.5.2 Pilot

A day of practical training of the fieldwork was conducted in one of the camps, Smara, before starting the study. Two women and their children were included in the pilot. Since the pilot went well and no corrections needed to be done the two participants were included in the results.

4.6 Practical performance

There were set aside one week for data collection in each camp. In each district, the women who were chosen to participate were gathered at the health station, and blood samples were taken from them one by one. After giving blood, the women were handed a bag of equipment to use when giving urine from their selves and their child, and a breast milk pump. They were closely explained how to use the equipment. The women were explained that a team of fieldworkers would come to visit them at home the next day, to collect the samples and the rest of the data; questionnaires and the anthropometrical measurements. The data collection in the households was carried out by two teams, each team consisting of a student, a local fieldworker and a driver. The local fieldworkers did most of the communication with the participants, in the native tongue of the refugees, Hassania. The communication between the student and the local fieldworkers were in Spanish. All the questionnaires were done by the local fieldworker interviewing the women. The collection of the biological samples and anthropometrical measurements were done by the students. There were also necessary for the students to observe and monitor the interviews of the women, and correct missing or confusing answers, or mistakes done by the local fieldworkers.

Picture 4-1 Bag of sampling equipment (urine cups, breast pump and urine bag) given the women

Each team visited 3-5 women per day, depending on how many districts that were covered, and how big the districts were. Normally a team used about one hour in each household. In some houses the women had some difficulties with giving some of the samples, in those cases the team had to make appointments to come back later the same day, or another day.

4.6.1 Determine iodine status for women and children

Urine samples

Two urine samples were collected in each household, one from the women and one from her child, as spot-urine samples. The urine sampling equipment and information of how to use it were given to the women at the local health station the day before visiting them in their home. The women collected her own and her child's urine sample in her home and gave it to the fieldworkers the next day during the visit. The women urinated directly into a 100 mL Vacuette urine cup, and the children were given Uri Max urine bags to urinate in, where the mother poured the urine into the child's urine cup when enough urine were collected. The urine cups were marked with ID numbers. For the women to know the difference between her cup and her baby's cup they were also marked with a drawing. The woman's cup had a drawing of a women and the child's cup had a drawing of a child. After a while there was a tendency for the women with baby girls to struggle with giving child urine. Therefore the women with baby girls were given ordinary plastic bags, for the child to urinate in. Vacuette 9 mL transmission units were used to take up the urine from the urine cups by the students. The transmission unit tubes were marked with ID number, and the samples were stored in the tubes until analyses. The samples were kept frozen at minus 20 until departure to Norway. Under the travel the samples were kept in cooling bag surrounded by cooling coils. The samples were kept in the same way, when sent for analyses.

Analyses of the iodine concentration in the urine samples were performed at the Nutritional Intervention Research Unit (NIRU) in Cape Town, South Africa. The samples were analysed according to the Sandell-Kolthoff reaction (Jooste & Strydom, 2010). NIRU was accredited for the analyses done by the Sandell-Kolthoff reaction, and the method has generally a variation coefficient under 10% (WHO, 2004b).

4.6.2 Determine iodine intake for women and children

Through questionnaire 3, "iodine intake women" the intake of iodine rich drinks were registered in a 24 hour recall and a seven days recall. The 24 hour recall data was collected to be able to examine how the diet could affect the UIC and BMIC, and at what quantity the different drinks were consumed among the women. The seven days recall data was collected to be able to examine the amounts iodine consumed during a week, and to be able to see if the

24H recall data corresponded with the amounts reported eaten/ drunken during a week. The 7 days data was also planned out to be used in the follow-up study. The women were asked to show the amount that she had been drinking each day of the week. When doing this each woman used her own household equipment that was used for the specific type of drink. After showing the amount, it was poured in a Capere digital kitchen scale, measuring down to the nearest gram, and the amount was written down in the questionnaire.

To examine the food intake of the children, the questionnaire "breastfeeding practises" were used. The local fieldworkers interviewed the mother of the child. The 24H data for the children was used to check the diet's association with UIC. The 7 days data was used to assess general feeding practises, and to check if the 24H recall data corresponded with the foods and drinks reported eaten/ drunken during a week.

Picture 4-2 One of the local fieldworkers interviewing a women

4.6.3 Human milk samples

The Harmony manual breast pump was used to collect the human milk samples. The women were given the pump the day before the home-visit with instructions on how to use it. They were asked to give 20 ml milk, which was marked by a drawn line on the container of the breast pump. After giving milk the women were told to keep the milk in the container unit of the pump and sealing it with the pertaining cap. When collecting the sample from the women, the breast milk was poured over to a 50 ml falcon tube, marked with ID number and what it contained. The samples were kept frozen at minus 20 degrees Celsius until departure to Norway, and were kept in cooling bags with cooling units during transport to Norway.

Back in Norway the samples were sent in cooling bags for analyses at the National Institute of Nutrition and Seafood Research, (NIFES), in Bergen, Norway. The milk samples were analysed with the Inductively Coupled Plasma - Mass Spectrometry method (ICP-MS) which the laboratory were accredited for. ICP-MS is considered a useful method for determination of iodine content in foodstuffs (Dahl, 2003).

4.6.4 Anthropometrical measures

Height and weight was measured for the women and the children. To measure the weight a digital solar powered tare platform manufactured by Seca for UNICEF was used. The scales were calibrated before and during the fieldwork. The women's weight was registered to the nearest 100 grams. Between 500-1500 grams were taken off depending on the amount of clothes they were wearing. When the women were standing on the scale, the weight was reset and the baby put in her arms. The baby had as little clothes on as possible. The weight of the baby was taken to the nearest 100 grams. If the children were wearing a diaper or some clothes 100-200 grams were subtracted from the weight. The length of the women and children was measured using a UNICEF length board. The women were measured standing with the heels, shoulders and head against the back of the board, looking straight forward. The measurement was taken to the nearest mm. The children were measured lying down on the board, while one person was holding the head against the upper plate of the board, and the other pressing down the knees and pushing the bottom plate against the sole of the feet. The measurement was taken to the nearest mm.

Cut-off values used to determine the women's weight status was the Body Mass Index (BMI) scale for adults, classifying people as underweight, normal weight, overweight or obese using WHOs cut off values (WHO, 2011). For the children the WHO child growth standards was used as references, using weight-for-age (underweight), weight-for- length (wasting), and length-for-age (stunting), with the ± 2 standard deviations (z-scores) to determine over and under nutrition (WHO, 2006, 2010).

4.6.5 Water samples

There were taken 6 samples of public water from each camp. Fifty ml sealed falcon tubes were used. The water samples were kept in room temperature under the period in field and during transport. Analyses were performed at the Nutritional Intervention Research Unit (NIRU) in Cape Town, South Africa. The samples were analysed according to the Sandell-Kolthoff reaction (Jooste & Strydom, 2010).

4.6.6 Animal milk samples

Animal milk samples were taken in the households where the women stated that they had been drinking milk during the last week. About 20 ml samples were taken in 50 ml sealed falcon tubes. The samples were stored at minus 20 degrees Celsius until departure, and kept cold during the travel to Norway. The samples were kept cool under transport to Bergen, where the analyses were done at NIFES. The milk samples were analysed with the ICP-MS (Dahl, 2003).

Before leaving to Norway the health director in the camps sent a letter to the Polisarian represent in Alger to show the Algerian customs authorities, to be able to leave with the samples. The letter from the health director is found in attachment 20.

4.10 Processing data and statistical analyses

Processing of the iodine intake data were done in the calculation programme Excel. The anthropometrical data for the children were processed in Smart for Emergency Nutrition Assessment (ENA), which is a software for nutrition assessment of children based on the WHO child growth standards from 2005 (“ENA software”, 2009). All data were included in the statistical software PASW (Predictive Analytics SoftWare) version 18.0.0 (“IBM SPSS Statistics Family”, 2010), for further processing and statistical analyses. All data were manually entered into the software’s by the students. Frequencies were done on all variables before starting to analyse, to detect possible miss-punches.

4.10.1 Processing and recoding of data

The food data from questionnaire 3 were used to calculate the amount of iodine consumed by the women the last 24 hours and the last 7 days. The intake of water, from drinking water, water mixed with milk and soup water was used to calculate the total water intake in grams. Tea water was not used, since all the participants had used bottled water for this purpose, which is not containing much iodine. Also the amounts in grams of goat milk and camel milk were calculated from the 24 hour recall data and the 7 days data.

To be able to estimate the intake of iodine from water, goat milk and camel milk the amount consumed in grams from each of the drinks were multiplied with the iodine concentration of the respective drink in µg/mL. This gave the amount iodine eaten in µg per day and per week from the goat milk, camel milk and total water. When calculating the iodine intake from water, the median iodine concentration of public water from each camp was used, giving one value to use for each camp. All the women reported that they used public water as household water, except from when they were making tea. The milk consumed was always mixed with water, and the mixture ratio was calculated for each woman to be able to assess the amount of water and the amount of milk drunken from the mix. For calculation of goat and camel milk iodine intake, the respective sample was used for the women who had been giving samples. For the ones who reported that they had been drinking animal milk, but did not have any milk left for a sample a median value was used for the current milk type. Other milk types, Candia milk[5] and powder milk were only used for water intake calculation, since the milk itself did not contain much iodine.

Recoding of some of the categorical variables was done when there were too few in one or several categories to have statistical basis to go through with tests. The cases where recoding was necessary will be explained further in the result chapter. Some variables were also recoded for regression analyses into 0-1 codes, and will be specified in a later section.

The results revealed (table 5-5 and 5-6) showed that there were generally higher iodine concentrations in water, animal milk, breast milk and urine in two of the camps. Therefore the sample was divided into a "low iodine area" consisting of the camps Smara and Dajla and "high iodine area" consisting of the camps Aaiun and Auserd. For the regression analyses the whole sample was used, but to test for differences in food and drink intakes, the low and high iodine area will be used throughout.

[5] Imported cows milk treated with ultra high temperature to keep fresh.

4.10.2 Description of data

The variables were tested for normal distribution using the Saphiro-Wilks test of normality, using significance level of $> 5\%$ to indicate normal distribution, and $\leq 5\%$ to indicate non normal distribution.

For the normally distributed variables *age for women, age for children, height for women, weight for women, BMI for women, weight-for-age children, number of children alive, number of children dead and "number of children* < 5 *years* , parametrical measures were used. For the variables *age for women, age for children, number of children alive, number of children dead* and *number of children* < 5 *years* the central measure used was mean, and min-max measures for variation. For the rest of the parametrical variables mean and ±standard deviation (SD) were used. The rest of the variables used were not normally distributed, and non-parametrical measures were used. Central measure was median and 27 and 75 percentiles were used for variation.

4.10.2 Analyses

Hypothesis testing is used in this thesis to see effects of differences between variables and influences of several variables on one variable.

Differences between groups or conditions

The parametrical independent samples T-test were utilised on the variables *BMI for women, weight-for-age children, height-for-age children, weight-for-height children, age for women* and *age for children* to see differences between groups. For the rest of the variables non parametrical tests were used. To test for differences between variables in groups the Mann-Whitney U test were used throughout for one continuous and two categorical variables. For only categorical variables the Chi-Square test was used, where Yates Correction of continuity were utilized in 2x2 tables and while the Pearson Chi-Square test were used for variables with more than two categories. A significance level of 5% was used in all of the tests.

Relations between several variables

UIC for women, UIC for children and *BMIC* were dependent variables in multiple linear regression analysis. Because of not normally distributed data, the following formula was used to check for outliers: Q1-1,5 IQR and Q3+1,5IQR. Intra quartile range (IQR), were calculated by subtracting Q1 (1^{st} quartile/ 25 percentile) from Q3 (3^{rd} quartile/ 75 percentile). This formula includes both outliers and conditional outliers and was used in order to make acceptable distribution for the dependent variables, which are defined as residual values between -3,3 and 3,3 (Moore, 2000). The values below Q1-1,5IQR and above Q3+1,5IQR were excluded from the regression analyses. For the variable *UIC women* the lower cut off were -271,0697 and the upper cut off were 1004,9754. From the upper cut off 7 women were excluded. For the variable *UIC children* the lower cut off were -714,8053 and the upper cut off were 2260,2767. Eight children were excluded from the regression analyses using the upper cut off level. For *BMIC* the lower cut off was -227,3750 and the upper cut off was 1259,6250, where 3 women were excluded being above the upper cut off. Using the formula n= ˃ 50 +8m (where m is the number of independent variables) the sample size is sufficient for regression analyses in the final models (Pallant, 2005).

All the independent variables were checked for multicollinearity, by using correlation tests. Correlation coefficients above 0,9 are recommended removed from the model (Pallant, 2005). In this case none of the independent variables showed too strong correlations. Linear simple regression analyses were used for detecting associations between the dependent variable and selected dietary components and background variables. *UIC for women* were assessed for association or not with the following variables; *BMI*, *Age*, *BMIC*, *Water iodine intake 24H*, *Goat milk iodine intake 24H* and *Camel milk iodine intake 24H*. *BMIC* were assessed for association or not with the following variables; *BMI*, *Age*, *UIC, Water iodine intake 24H*, *Goat milk iodine intake 24H* and *Camel milk iodine intake 24H.* And *UIC children* were assessed for associations with the variables *Weight-for-age*, *Age*, *BMIC, Breast feeding frequencies, Goat milk intake 24H*, *Camel milk intake 24H*, *Water intake 24H*, *Solid or semi solid food intake 24H* and *Diarrhoea*. In the regression models where *UIC women* and *BMIC* were dependent variables, all independent variables were continuous. For the *UIC children* the following categories were used: categories for goat milk given yesterday: 0=not given, 1= given. Categories for camel milk given yesterday: 0=not given, 1= given. Categories for total water given yesterday: 0=not given, 1= given. Categories for solid or semi-solid foods: 0=Not given solid or semi-solid foods yesterday, 1= given solid or semi solid foods yesterday. Categories for breast feeding frequencies: 0= breast fed 1-10 times yesterday during the day, 1= breast fed ≥11 times yesterday during the day. Categories of diarrhoea: 0= not had diarrhoea last two weeks, 1=had diarrhoea last two weeks.

Altman suggests that in simple regression analyses used for building multiple regression models, a p-value of 0,2 should be used. Only the variables showing significant contribution to the variance of the dependent variable ($p < 0,2$) were included in a preliminary multiple model. Variables that were still significantly associated in this model ($p<0,2$) were retained in the final model, presented in the result chapter.

5 Results

5.1 *Sample*

One hundred and forty-nine women and their children were asked to join the study by the health director and the head of the local health station. Six women said no to participate, and 33 did not meet the inclusion criteria's, whereas 16 women had babies that were over 7 months of age and 17 were not lactating. The sample consisted of 112 women and 112 children, including the participants from the pilot study. From the 112 women who were selected to participate, 3 women had to be excluded during the study, since it appeared their babies did not meet the inclusion criteria's after all, being too old. Two new participants were found to replace the dropouts. One woman was not able to give breast milk, and was therefore excluded from the analyses. The final sample consists of 110 women and 110 children, 220 in total, see figure 5-1.

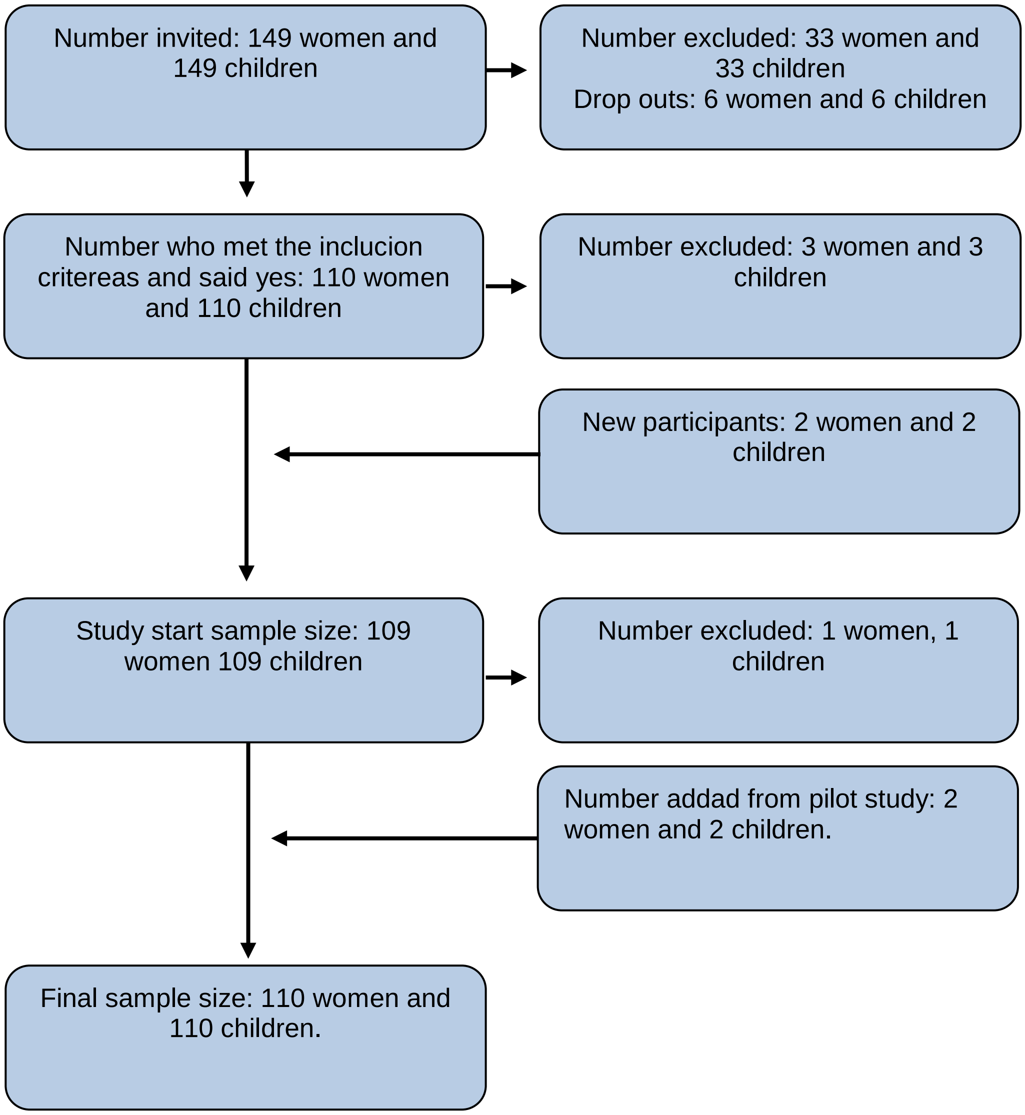


Figure 5-1 Flowchart over sampling procedure

The sample consisted of lactating women with their children from 0 up to 7 months of age. Of the 110 women the mean age was 31 years, minimum and maximum age was 18 and 50 years. Among the children 64 % were girls (n=70), and 36 % were boys (n=40), see table 5-1. No significant differences in age were found between boys and girls.

Table 5-1 Description of the sample, women and children, Saharawi refugee camps, November 2010

	Women (n= 110)
Age, years (mean (min-max))	31,8 (18-50)
No education (%)	6
Education between 1st and 9th grade (%)	71
Education > 9 th grade (%)	23
Number of children <5 years (mean, (min, max))	1,6 (1-3)
Number of children alive (mean, (min, max))	3,2 (1-10)
Women with dead children (%)	16
Attended health controls when pregnant (%)	90
	Children (n= 110)
Age, months (mean (min-max))	3,0 (0,6)
Boys (%)	36
Girls (%)	64

Using the WHO child growth standards (WHO, 2010) the anthropometrical measurements showed that 14% of the children were suffering from global acute malnutrition with a z-score ≤-2, 26% were underweight with a z-score ≤-2 and 23% were stunted using z-score ≤-2. There were 4% of the children that were defined too big for their age with a z-score > 2. No significant differences were found in the different child growth indicators between boys and girls.

The women has been defined as underweight (BMI < 18,5), normal weight (BMI 18,5 - 24,99), overweight (BMI ≥ 25,0) and obese (BMI ≥ 30,0) using the WHO cut off values (WHO, 2011). Among the women, the mean BMI was 26,95 kg/m ^{2}, and 68 % of the women were overweight or obese. Only 3 % of the women were underweight, see table 5-2 for closer mention about the prevalence of over- and underweight among women and children.

Table 5-2 Prevalence of over- and underweight among women and children, Saharawi refugee camps, November 2010

	Women (n= 110)
Weight, kg (mean (min-max))	66 (34- 95)
Height, cm (mean (min, max))	156 (145- 167)
Underweight, <18,5 kg/m^2 (%)	3
Normal weight between 18,5-24,99 kg/m^2 (%)	29
Over weight ≥ 25,0 kg/m^2 (%)	44
Obese BMI ≥ 30,0 kg/m^2 (%)	24
	Children (n= 110)
Moderate acute malnutrition, -3 and ≤-2 z-score (%)	12
Severe acute malnutrition, ˂ -3 z-score (%)	2
Global acute malnutrition, ≤-2 z-score (%)	14
Moderate underweight, -3 and ≤-2 z-score (%)	18
Severe underweight, ≤-3 z-score (%)	9
Total underweight, ≤-2 z-score (%)	26
Moderate stunting, -3 and ≤-2 z-score (%)	15
Severe stunting, ≤-3 z-score (%)	8
Total stunting ≤-2 z-score (%)	23

Source: Cut off values used: (WHO, 2011).

The women reported that 33 % of the children have had diarrhoea during the last two weeks, and 35 % had other kind of diseases, reported to be cold, fever or vomit. There were who 9 % had had both diarrhoea and another disease.

To see if the women and children's weight and age were equally distributed in the high and low iodine area, these variables were tested for differences, see table 5-3. The weight parameter used for the women was BMI, and for the children weight-for –age and height-for-age and weight-for-height was used. There were no significant differences in BMI or age for the women between the areas. For the children no significant differences were seen between the areas in age, weight- for-age and height-for-age, but there were significant differences in weight-for-height, showing that the wasting prevalence was significantly higher in the low iodine area.

Table 5-3 Weight and age for women and children in low iodine and high iodine area, Saharawi refugee camps, November 2010

	Low iodine area	High iodine area	p-value[b]
BMI women (mean ±SD)[a]	27,0 (3,7)	27,0 (5,4)	0,884
Age women (mean (±SD)) [a]	31,5 (5,8)	31,3 (6,1)	0,886
Weight-for-age children in z-score (mean (±SD)) [a]	-1,1 (1,4)	-0,8 (1,4)	0,294
Height-for-age children in z-score (mean (±SD)) [a]	-0,7 (1,3)	-0,9 (1,4)	0,528
Weight-for-height in z-score (mean (±SD)) [a]	-0,7(1,2)	-0,07 (1,3)	0,023*
Age children (mean (±SD)) [a]	3,2 (1,7)	2,9 (1,8)	0,367

[a] ± 1 standard deviation. [b] Differences between areas tested with independent samples T-test. *Significant.

Table 5-4, show the prevalence of diarrhoea and disease the last two weeks among the children within the two areas. There were significant differences in diarrhoea the last two weeks between the two areas, where the low iodine area has higher prevalence of diarrhoea (45%) than the high iodine area (20%). There were no significant differences in other diseases between the two areas.

Table 5-4 Prevalence of diarrhoea and other diseases in the low iodine and high iodine area, Saharawi refugee camps, November 2010

Child disease last two weeks			Low iodine area (n=55)	High iodine area (n=55)	Total	p-value[a]
Diarrhoea	Yes	% within area	45	20	33	0,008*
	Total	% within area	100	100	100	
Other disease	Yes	% within area	29	42	35	0,232
	Total	% within area	100	100	100	

[a] Differences in prevalence of diarrhoea and other diseases between the two areas tested by Chi-Square Test. *Significant.

5.2 Iodine concentrations of water, animal milk, breast milk and urine

Table 5-5 show the variations in iodine concentrations in water, goat milk and breast milk between each camp or between the different origins. The median (p25-p75) iodine content of water was 102 (80-225) µg/L for the four camps in total. The water samples were from the public water within each camp. The highest median iodine concentrations were found in Ausserd 236 (202-253) µg/L and Aaiun. 267 (220-276) µg/L. When collecting the animal milk samples, the women were asked about the origin of the milk. The goat milk was reported to always come from goats within each camp and had the camp where it was collected as its origin. The total goat milk samples had a median iodine concentration of 952 (801-1787) µg/L. The highest median iodine concentration in goat milk was seen in the samples from

Auserd 2740 µg/L and Aaiun 912 (801-1787) µg/L. Because there were only two samples from Auserd, there was no basis for calculating the 25 and 75 percentiles. The camel milk was often imported from the liberated area, and 2 camel milk samples had also unknown origin. The median iodine concentration of the total camel milk samples was 2020 (1002-4137) µg/L. Smara and Auserd had the highest median iodine concentrations within the camps, with median iodine concentrations of 3770 (1960-4590) µg/L and 1810 (1320-4912) µg/L respectively. But the highest concentrations were seen in the milk from the liberated area, showing a median iodine concentration of 2490 (1502-4137) µg/L. The median BMIC was 479 (330-702) µg/L across all the camps. The iodine concentrations in breast milk were highest in Auserd 608 (440-973) µg/L and in Aaiun 615 (450-893) µg/L.

Table 5-5 Median iodine concentration of water, goat milk, camel milk and breast milk within camps or areas, Saharawi refugee camps, November 2010

Camps	Water iodine concentration in µg/L (median (p25-p75))[a]
Smara (n=6)	90 (75-100)
Auserd (n=6)	236 (202-253)
Dajla (n=6)	76 (63-81)
Aaiun (n=6)	267 (220-276)
Total (n=24)	102 (80-255)
Milks origin	**Goat milk iodine concentration in µg/L (median (p25-p75))[a]**
Smara (n=2)	827[b]
Auserd (n=2)	2740[b]
Dajla (n=1)	323[b]
Aaiun (n=8)	912 (844-1397)
Total (n=13)	952 (801-1787)
Milks origin	**Camel milk iodine concentration in µg/L (median (p25-p75))[a]**
Smara (n=7)	3770 (1960-4590)
Auserd (n=6)	1810 (1320-4912)
Dajla (n=3)	525 (210-1262)
Aaiun (n=1)	1560[b]
Liberated area (n=15)	2490 (1760-4190)
Unknown (n=2)	4230[b]
Total (n=34)	2020 (1502-4137)
Camps	**Breast milk iodine concentration in µg/L (median (p25-p75))[a]**
Smara (n=40)	398 (269-525)
Auserd (n=25)	608 (440-973)
Dajla (n=15)	318 (255-465)
Aaiun (n=30)	615 (450-893)
Total (n=110)	479 (330-702)

[a] 25 and 75 percentiles. [b] No basis for calculating 25 and 75 percentiles.

The UIC for women and children are presented in table 5-6, and show the median UIC within each camp and total. The total median UIC for the women was 349 (207-526) µg/L, and for the children the total median UIC was 728 (401-1145) µg/L. For both the women and the children the highest median UIC values were found in Auserd and Aaiun. Where the women's median UIC was 462 (349-656) µg/L in Auserd and 376 (249-735) µg/L in Aaiun. The children from Auserd had a median UIC of 876 (562-1310) µg/L and the children from Aaiun had a median UIC of 873 (546-1389) µg/L.

Table 5-6 Median UIC for women and children within each camp, Saharawi refugee camps, November 2010

Camps	UIC for women in µg/L (median (p25-p75))[a]
Smara (n=40)	314 (197-556)
Auserd (n=25)	462 (349-656)
Dajla (n=15)	109 (98-290)
Aaiun (n=30)	376 (249-735)
Total (n=110)	349 (207-526)
Camps	**UIC for children in µg/L (median (p25-p75))[a]**
Smara (n=40)	552 (373-1013)
Auserd (n=25)	876 (562-1310)
Dajla (n=15)	392 (255-823)
Aaiun (n=30)	873 (546-1389)
Total (n=110)	728 (401-1145)

[a] 25 and 75 percentiles.

5.3 *Women's iodine intake and urinary iodine in connection with breast milk iodine content.*

Simple regression models were used to identify predictors for *UIC for women* and *BMIC*. The predictors with significant association are presented in table 5-7 and 5-8, where the unadjusted effects from simple regression also are shown.

In the final model *BMI* and *goat milk iodine intake 24H* was positively associated with *UIC for women*, and explained 9,9 % of the variation in *UIC for women*, see table 5-7. *BMI* was the variable that explained most of the variation, with a standardised beta of 0,296. From the adjusted effects one can see a mean change of 15,3 in *UIC for women* when the value of *BMI* increases with one unit. *Camel milk iodine intake 24H* showed a smaller association with a standardised beta value of 0,174. The adjusted effect show that the mean change in *UIC for women* is 0,16 as the *camel milk iodine intake 24H* increases with one unit.

Table 5-7 Determinants for UIC in lactating women in multiple regression models, n=103. Saharawi refugee camps, November 2010

Variables	Unadjusted effect (95% CI (lower, upper))[a]	p-value[b]	Adjusted effect (95% CI (lower, upper))[c]	p-value[d]	Standard beta[e]
Constant			-59,15 (-326,85, 208,54)	0,662	
BMI	14,61 (4,85, 24,36)	0,004*	15,28 (5,61, 24,95)	0,002*	0,296
Camel milk iodine intake	0,14 (-0,039, 0,318)	0,125*	0,16 (-0,012, -0,332)	0,068*	0,174
R^{2f}				0,093	

Dependent variable: UIC women. [a] Unadjusted effect from simple regression. [b] Tested with simple standard regression. [c] Adjusted effect for the other variables in the table in multiple regression analysis. [d] Tested with multiple regression. [e] Standardized indicator of effect strength. [f] Explained variation in dependent variable. *Significant association with a significance level of 0.2.

Predictors for *BMIC* were also assessed in a multiple regression model, where *BMIC* were positively associated with *water iodine intake 24H*, *goat milk iodine intake 24H* and *UIC for women*, see table 5-8. These variables explained 15,8 % of the variation in *BMIC*. *Water iodine intake 24H* explained most of the variation, with a standardised beta of 0,319. The adjusted effect shows a mean increase in BMIC of 0,288 as *water iodine intake 24H* increases with one unit. *Goat milk iodine intake 24H* had a less strong association with *BMIC* and had a standardised beta value of 0,167. The adjusted effect showed that *BMIC* increased with 0,371 as the *goat milk iodine intake 24H* increased with one unit. The variable that explained the least of the variation was *UIC*, and showed a standardised beta of 0,161. The adjusted effect show that *BMIC* increases with 0,117 as the *UIC* increases with one unit.

Table 5-8 Determinants for BMIC for lactating women in multiple regression models, n=107. Saharawi refugee camps, November 2010

Variables	Unadjusted effect (95% CI (lower,upper))[a]	p-value[b]	Adjusted effect (95% CI (lower, upper))[c]	p-value[d]	Standard beta[e]
Constant			361,076 (273,72, 448,42)	˂0, 001	
Water iodine intake	0,318 (0,154, 0,482)	˂0,001*	0,288 (0,126, 0,45)	0,001*	0,319
Goat milk iodine intake	0,516 0,099-0,934)	0,016*	0,371 (-0,028, 0,77)	0,068*	0,167
UIC women	0,137 (-0,001, 0,275)	0,052*	0,117 (-0,012, 0,246)	0,076*	0,161
R^{2f}				0,158	

Dependent variable: BMIC. [a] Unadjusted effect from simple regression. [b] Tested with simple standard regression. [c] Adjusted effect for the other variables in the table in multiple regression analysis.. [d] Tested with multiple regression. [e] Standardized indicator of effect strength. [f] Explained variation in dependent variable. *Significant association with a significance level of 0.2.

Table 5-9, show the total iodine intake from water, camel milk and goat milk, from the 24 hour recall and 7 days data in the low and high iodine areas and both of the areas totally. The total median iodine intake from both the areas from the 24H recall data was 409 (234-709) µg/L. The high iodine area had a median total iodine intake that was 245 µg higher than for the low iodine area, and there were significant differences between the areas.

Total median iodine intake from both the areas from the 7 days recall data was 2463 (1177-3978) µg/L, and the high iodine area had a median total iodine intake that was 1145 µg higher in the high iodine area than in the low iodine area. There were significant differences in iodine intake between the two areas also from the 7 days data.

Table 5-9 also show the median UIC and BMIC for women in the two areas. The median UIC was 243 (160-476) µg/L in the low iodine area, and 385 (288-675) µg/L in the high iodine area. There were significant differences in UIC between the two areas. The BMIC in the low iodine area was 379 (263-514) µg/L and 608 (450-905) µg/L in the high iodine area. There were significant differences between the areas in BMIC.

Table 5-9 Total iodine intakes, UIC and breast milk iodine for women in the high iodine and low iodine area, Saharawi refugee camps, November 2010

Area	Total iodine intake 24H in µg/day (median (p25-p75))[a]	p-value[b]
Low iodine area (n=55)	307 (157-513)	< 0,001*
High iodine area (n=55)	552 (387-874)	
Total (n=110)	409 (234-709)	
Area	**Total iodine intake 7 days in µg/day (median (p25-p75))[a]**	
Low iodine area (n=55)	2111 (780-3115)	< 0,001*
High iodine area (n=55)	3256 (1810-4871)	
Total (n=110)	2463 (1177-3978)	
Area	**UIC for women in µg/L (median (p25-p75))[a]**	
Low iodine area (n=55)	243 (160-476)	0,02 *
High iodine area (n=55)	385 (288-675)	
Area	**Breast milk iodine in µg/L (median (p25-p75)) [a]**	
Low iodine area (n=55)	379 (263-514)	< 0,001 *
High iodine area (n=55)	608 (450-905)	

[a] 25 and 75 percentiles. [b] Differences between the two areas tested by Mann-Whitney U test. *Significant.

The 7 days iodine intake were used to check the 24H data for validity, where the intake per day from the 7 days data were correlated with the 24H intake data by using the Spearmans test of correlation. For water intake the 7 days data per day correlated with the 24H data with a correlation coefficient (R^{sp}) of 0,794, for the camel milk the data correlated with an R^{sp} of 0,922 and the goat milk data correlated with an R^{sp} of 0,982. All of the correlations were significant with a p-value $<$ 0,001.

To look closer into the intakes between the high iodine and low iodine areas, both the intakes and iodine intakes from the different drinks were compared between the areas using the 24H recall data, see table 5-10. For the camel and goat milk, only the ones who had been drinking the respective milk types were included. There were in total 50% who drunk camel milk the last 24H and 19% who drunk goat milk. All the women had been drinking water yesterday.

As seen in the table (5-10) there were no significant differences between the low and high iodine areas in amounts of total water drunken yesterday, where the low iodine area had a median water intake of 1745 (1286-2745) g and the high iodine area had a median water intake of 1776 (1154-2761) g. For the iodine intake from water on the other hand, there were significant differences between the two areas, with a median iodine intake from water of 157 (108-217) µg in the low iodine area and 458 (272-691) µg in the high iodine area. For the camel milk intake, there were significant differences in camel milk drunken yesterday between the two areas. The low iodine area had a median camel milk intake of 120 (87-190) g and the high iodine area had a median camel milk intake of 85 (56-116) g, showing that the low iodine area had a higher median camel milk intake than the high iodine area. The low iodine area had a median iodine intake from camel milk of 262 (163-465) µg and the high iodine area had a median iodine intake from camel milk of 172 (99-262) µg, also here there were significant differences between the areas. The median goat milk intake yesterday was 145 (65-204) g in the low iodine area and 76 (46-100) g the high iodine area. And the median iodine intake from goat milk was 99 (54-193) µg in the low iodine area and 91 (44-227) µg in the high iodine area. There were no significant differences either in goat milk intake or iodine intake from goat milk between the two areas.

Table 5-10 Intake of total water and animal milk and iodine intake from total water and animal milk in high iodine and low iodine areas, Saharawi refugee camps, November 2010

	Low iodine area (n=55)	High iodine area (n=55)	p-value[b]
Total water intake in g 24H (median ((p25-p75))[a]	1745 (1286-2745)	1776 (1154-2761)	0,846
Total water iodine intake in µg 24H (median ((p25-p75))[a]	157 (108-217)	458 (272-691)	<0,001*
	Low iodine area (n= 26)	**High iodine area (n= 29)**	**p-value[b]**
Camel milk intake 24H (median ((p25-p75))[a]	120 (87-190)	85 (56-116)	0,012*
Camel milk iodine intake 24H (median ((p25-p75))[a]	262 (163-465)	172 (99-262)	0,041*
	Low iodine area (n= 8)	**High iodine area (n=13)**	**p-value[b]**
Goat milk intake 24H (median ((p25-p75))[a]	145 (65-204)	76 (46-100)	0,218
Goat milk iodine intake 24H (median ((p25-p75))[a]	99 (54-193)	91 (44-227)	0,885
	Low iodine area (n=32)	**High iodine area (n=35)**	**p-value[b]**
Total animal milk intake in g 24H (median ((p25-p75))[a]	129 (97-223)	87 (64-135)	0,01*
Total animal milk iodine intake in µg 24H (median ((p25-p75))[a]	278 (173-460)	177 (99-272)	0,03*

[a] 25 and 75 percentiles. [b] Differences tested with Mann-Whitney U test. *Significant.

5.4 *Children's UIC and iodine intake*

Simple regression models were used to identify predictors for *UIC for children*. *BMIC* seemed to be the only variable having a significant association to the variation in *UIC for children*, explaining 9,9 % of the variance. *BMIC* had a standardised beta of 0,328. Because of only one variable in the regression model only the unadjusted effect is presented, which show a mean increase of 0,554 in *UIC* as *BMIC* increases with one unit, see table 5-11.

Table 5-11 Determinants for UIC for children in multiple regression models, n=102. Saharawi refugee camps, November 2010

Variables	Unadjusted effect (95% CI (lower, upper))[a]	p-value[b]	Standard beta[e]
Constant	468,67 (284,59, 652,75)	<0, 001	
Breast milk iodine	0,554 (0,238, 0,871)	0,001	0,328
R^{2f}		9,9	

Dependent variable: UIC children. [a] Unadjusted effect from simple regression. [b] Tested with simple standard regression. [e] Standardized indicator of effect strength. [f] Explained variation in dependent variable. *Significant association with a significance level of 0.2.

5.4.1 Feeding and breast feeding practises

All the children in the study were breastfed. Based on the 7 days frequency data of children's food and drink intake, a very little proportion, 6 % of the children were exclusively breastfed. The 24 hour recall data showed that there were 12 % of the children who were given only breast milk the last 24 hours. In total 23 % of the women had given her child another drink before starting to breastfeed for the first time and 9 % reported to have been giving sugar water, 13 % had been given both sugar water and oil water and one women, 1 % had given formula.

There were 87 % of the women who reported to be breastfeeding her child on demand of the child, while 13 % said they breast fed their child on fixed intervals. All the women had breastfed their child during the day the last 24 hours, and all except one had also been breastfeeding during the night the last 24 hours. Over 50 % reported to have breastfed over 11 times the last day, and between 1-5 times the last night, see figure 5-2.

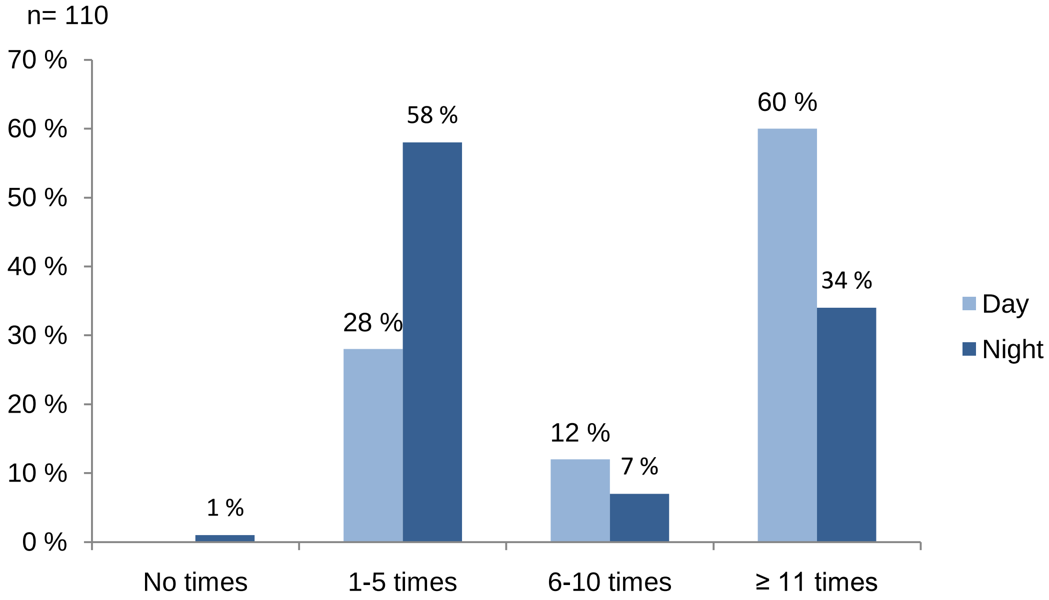


Figure 5-2 Distribution in percent of times breastfed yesterday during the day and night, Saharawi refugee camps, November 2010

All of the women said that the times they breastfed yesterday during the day was normal for them. During the night 97 % said the times they breastfed their child was a normal night, while 3 % said that the times they breastfed during the night was not normal, and would usually breastfeed more frequently.

Table 5-12 show variations in how often the child was breastfed between the high iodine area and low iodine area. In the category “6-10 times” there were few answers for both the day and night variables, as seen in figure 5-2. To test for differences between the camps the category “6-10 times” were merged with the category “1-5 times” to get sufficient frequency in each cell for both the day and night variables. The one person who answered “no times” for the breast feeding frequencies during night was excluded. The test categories were therefore “1-10 times” and “≥11 times”. There were no significant differences in breast feeding frequencies between the two areas during the daytime breast feeding. For the night time breast feeding frequencies there were significant differences between the two areas.

Table 5-12 Breastfeeding frequencies in the low iodine- and high iodine area, Saharawi refugee camps, November 2010

	Breast feeding frequency		Low iodine area (n=54)	High iodine area (n=55)	Total	p-value[a]
Day	1-10 times	% within area	35	45	40	0,33
	≥11 times	% within area	65	55	60	
	Total	% within area	100	100	100	
Night	1-10 times	% within area	54	78	66	0,013*
	≥11 times	% within area	46	22	34	
	Total	% within area	100	100	100	

[a] Differences between areas and breastfeeding frequency tested by Chi-square test. *Significant.

The iodine intake from breast milk were calculated in different age groups, using values estimated by the WHO for mean breast milk intake in grams per day for infants 1-6 months of age, see table 5-13. These calculated amounts were multiplied with the median iodine content in µg/mL in breast milk from the high iodine and low iodine areas, to find the estimated iodine intake in µg/day. The mean estimated iodine intake across age groups for the low iodine area was 291 µg/day, and for the high iodine area the mean estimated iodine intake across age groups were 476 µg/day.

Table 5-13 Estimated iodine intake in age groups 1-6 months in the low iodine and high iodine areas, Saharawi refugee camps, November 2010

Age in months	Mean breast milk intake estimated from WHO (g/day)	Estimated iodine intake from breast milk in the two areas (µg/day)	
		Low iodine area	High iodine area
1	699	265	425
2	731	277	444
3	751	285	457
4	780	296	474
5	796	302	484
6	854	324	519
Mean		291	467

Source: (WHO, 2002)

In addition to breast milk, most children were given other foods and drinks. Almost half of the children, 46 % were given other liquids in addition to breast milk and no solid or semi-solid foods the last week. The liquids given the children were plain water, sugar water, oil water, formula, goat milk, camel milk and Candia milk. There were 47 % of the children who were given solid or semi-solid foods in addition to breast milk and/or other liquids the last week. The most common foodstuff to give was plain water, where 76 % of the women reported to have been giving to the child the last week. The second most common to give was dates, given by 34 % the last week, and the third most common were formula, given by 33 %.

Plain water, sugar water, oil water and formula were merged into one variable to be able to see the total water given to the child. For the last 24 hours 79% of the 110 women had been giving water to the child, 9 % had given goat milk, 7 % camel milk and 42 % had been given solid or semi-solid foods. For the last 7 days 87 % of the women reported to have been giving water to the child, 11 % had given goat milk, 10 % camel milk and 47 % had been giving solid or semi-solid foods.

The distribution of iodine-rich drinks given to the child the last 24H between the low iodine area and the high iodine area is shown in table 5-14. There were 80% of the women who reported to have been giving water to her child yesterday in the low iodine area and 78% in the high iodine area. In the low iodine area 11% and 13% of the women reported that they had given camel milk and goat milk respectively, to their child yesterday. And in the high iodine area there were 4% and 5% who had been giving camel and goat milk respectively during the last 24H. There were 38% of the women who reported that they had been giving solid or semi-solid foods to her child yesterday in the low iodine area and 45% the high iodine area. There were no significant differences between the areas in water, goat milk and camel milk given the child the last 24 hours.

Table 5-14 Total water, camel milk and goat milk given to the child last 24H and week in the low iodine and high iodine area , November 2010

Foodstuffs given			Low iodine area (n=55)	High iodine area (n=55)	Total	p-value[a]
Water	Yes	% within areas	80	78	79	1,00
last 24H	Total	% within areas	100	100	100	
Camel milk	Yes	% within areas	11	4	7	0,271
last 24H	Total	% within areas	100	100	100	
Goat milk	Yes	% within areas	13	5	9	0,320
last 24H	Total	% within areas	100	100	100	
Solid/semi-solid	Yes	% within areas	38	45	42	0,562
foods last 24H	Total	% within areas	100	100	100	

[a] Differences between areas tested by Chi-Square test.

The 7 days intake data were used to check the 24H data for validity, where the intake frequency per day from the 7 days data were correlated with the 24H intake frequency data by using the Spearmans test of correlation. The total water, camel milk, goat milk and solid or semi-solid foods given last 24H were correlated with the total water, camel milk, goat milk and solid or semi-solid foods given per day from the 7 days data. The water given last 24H correlated with the 7 days data per day with an R^{sp} of 0,786. The camel milk data correlated with an R^{sp} of 0,837, the goat milk data correlated with an R^{sp} of 0,917 and the solid and semi-solid foods given correlated with an R^{sp} of 0,863. All correlations were significant with a p-value $<$ 0,001.

5.4.2 UIC in children

Figure 5-3 shows the distribution curve of UIC among the children. No children had UIC <100 µg/L, 11% had UIC between 100 and 300 µg/L, 56% had UIC between 300 and 1000 µg/L and 33 % had UIC >1000 µg/L. The red line indicates the upper UI level of 300 µg from WHO (WHO, 2007), for school age children. This upper level is not meant for children less than two years, but is used here in since there is no upper UIC limit for infants. There were 89 % of the children in the sample who were ≥ the upper UIC limit for school age children.

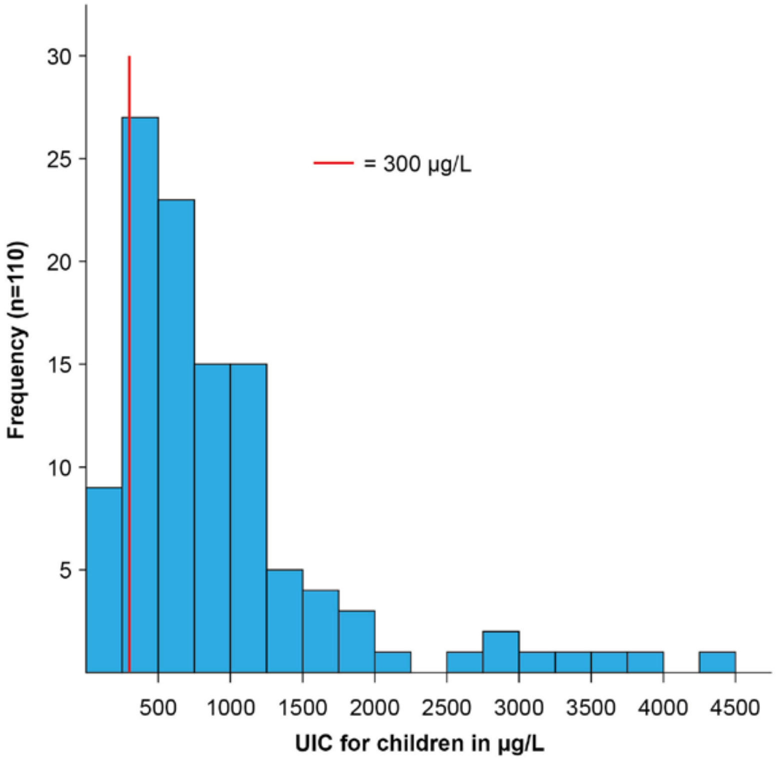


Figure 5-3 Distribution curve of UIC (µg/L) among children in all of the camps, Saharawi refugee camps, November 2010

The median UIC for children was 514 (365-918) µg/L in the low iodine area and 876 (561-1306) µg/L in the high iodine area. There were significant differences between the areas tested by Mann-Whitney U test, showing a p-value of 0,001.

6 Discussion

6.1 Discussion of sample and design

6.1.1 Sample selection

Previous studies among the Saharawi refugees in Algeria have shown high prevalence of goitre and high UIC among women and children 6-14 years and high iodine content in animal milk and drinking water (Barikmo et al., in press; SMH et al., 2008; UNHCR et al., 2002). This study have examined the iodine intake and iodine status of lactating women, the content of iodine in breast milk, the infants iodine status and how iodine content of breast milk and complementary foods can affect this.

There was planned out that women with children between 0-6 months of age should be included in the study, because children this age group are recommended exclusively breastfeeding. All the women included reported that the child's age met with this inclusion criteria. Even so, when visiting the women the birth data from the child's health card showed that the child was turned 6 months. These women and children were still included in the study, because there were problems finding enough women who met the inclusion criterias. Therefore the age limit was changed to include children between 0-7 months of age. There were 10 children in the sample that had turned 6 months. These 10 children were excluded from the analyses and the results showed that 7% were exclusively breast fed instead of 6 % when all children were included, and 43% of the children had been given solid or semi-solid foods instead of 47% when all children were included. This shows that there were very small differences in feeding practises between the sample where children from 0-7 months were included and children from 0-6 months, and the results still may be valid for children between 0-6 months since the older children did not transpose the results.

During the study in total 4 women and their children had to be excluded. Three of these women were excluded because their children were too old to participate (> 7 months). The last woman and child were excluded because the woman did not give a breast milk sample. There was decided to take in new participants to replace the drop-outs. Normally this is not a correct selection procedure (Ringdal, 2001). But because it was wanted to have a certain percentage share of participants from each camp, new participants were found in the camps where the drop-outs occurred.

When preparing the study in Norway the Saharawi health director indicated that there were possible to receive lists of participants to be able to draw participants randomly. After arriving to the camps, these lists were not available, and random selection of participants from lists could not be carried out. Instead the health director and the head of each local health station drove around and asked women with children from 0 up to 6 months of age to join the study. It cannot be ruled out that some women had greater probability of getting selected than others, and selection bias caused by non-participation may have occurred. The women the head of the health station and health director was familiar with were probably selected first. This may also be the situation for the women who attended health controls when pregnant, because the personnel on the local health stations probably were more familiar with these women than with the ones that not had been attending. This has to be considered concerning the possibility of generalise the findings of the study to the refugee women. Even so, 10 % of the women participating had not attended health controls at the health station when pregnant. If this is a representative share or not is uncertain. In seven of the districts there were few lactating women with children in the target age; therefore all of the women were selected from these districts and there were therefore no room for selection biases.

From the 149 women asked to participate only 4% answered no. This is a very little share, compared to other studies where a drop-out rate of 40% can be accepted (Ringdal, 2001). There is a possibility that these 4 % were different from the ones choosing to respond, but since the drop-out rate was so small there is no reason to believe that selection biases have occurred caused by differences in the respondents choosing to participate and not.

Some factors also make it probable that the variation between households in the camps is less than the variation between households outside the camps. The refugee situation and the location of the refugee camps made variations in living conditions and economic status less variable than for households outside the camps. The range of foodstuffs in the camps is very limited, and mostly came from food aid which does not give room for much individual variation in foods eaten. Each camp has its own source of public water, from where most of the refugees gets their water (Barikmo et al., in press), and the iodine concentration in drinking water was relatively similar within each camp.

The external validity says something about how representative the sample is for the population, and if the sample may be generalized (Cole, 1997). Considering the good respondent rate and the similar context factors for the women in the camps, the results from this study may probably be generalised to all breast feeding women with children (0-7 months) in the camps. On the other hand considering the rare conditions in the camps, the results cannot be generalized to women and children outside this area. However, the results might be relevant in population groups exposed to high iodine intakes.

6.1.2 Study design

A limitation with this cross sectional study design is that all the data were collected at the same point of time. This only gives a picture of the present situation, and is insufficient if one wants to see time aspects (Nelson, 1997). Observed changes over a time period by repeated cross sectional studies can reflect reliable time trends and changes. When comparing findings from different cross sectional studies, one cannot rule out that these findings may be caused by differences between the individuals participating in the studies at different time periods (Nelson, 1997). This is important to have in mind when the results from this study are compared to the findings in other cross sectional studies. This study was planned to be a baseline of a cohort, and therefore it will be possible to compare findings over time and make assumptions about associations and consequences for this study population when the next study is conducted in two years to come.

6.2 Discussion of methods

6.2.1 Questionnaires

The questionnaires were developed for this study by the two master students. During the training of the local fieldworkers, they were practising using the questionnaires by interviewing each other and the two students. When doing so the local fieldworkers gave feedback on how they meant the questionnaires worked, and many ambiguities and culturally misplaced questions or possible misunderstandings were corrected. None of the questionnaires seemed to pose problems for the fieldworkers when interviewing the participants; neither did the participants have any troubles understanding the questions. The fieldworkers were trained to ask the questions as precise and similar as possible and ambiguities concerning the interviews were checked and corrected the same day through discussions with the fieldworkers. The students were present at every interview assuring good quality of each interview. This were done by checking that the time aspect was quite similar in each interview and between interviewers, assuring that the fieldworkers did not become inaccurate or careless as they were more familiar with the questionnaires. The two students were also frequently switching fieldworkers to assure that they were working and asking questions quite similar. Still there are possible that some questions were understood different between individuals.

Even if the fieldworkers helped transforming the questionnaires into the cultural context of the area, one question in particular posed some ambiguities. In questionnaire number 2; "Breast feeding practises", there were questions about how many times the women had breast fed her child during the day time and during the night time. During day time 60% of the women said they breastfed their child more than 11 times, and 34% reported that they breastfed more than 11 times during the night. With the understanding that exists on breast feeding in the Norwegian culture, breast feeding a child more than 11 times in one night seems very much. After discussion with some of the participants and the local fieldworkers there was understood that the Saharawi women had their children by their breasts almost at all times during the day and night, so the child could have milk whenever they wanted. This was normal practise for all the women in this culture with children up to one year's age. This has to be considered when reading the breast feeding frequencies results, and the answers may not be used as an indicator of how many meals the child had been given.

6.2.2 Dietary intake

Because of a limited time frame and the scale of the thesis, there was not possible to include all foods and drinks containing iodine in the food intake questionnaire used for the women. A previous study found the animal milk and water to be the most significant iodine sources in the diet, and other foods contained very small amounts of iodine compared to these main sources (SMH et al., 2008). Foods like rice and lentils could have been included in the questionnaire, since such foods absorb much water when boiled. Still they were let out, because of the small amount of iodine this would have contributed with compared to the iodine from drunken water, and the extra amount of work it would involve. Even so, other foods and drinks would probably have contributed to the total iodine intake.

Interviewed information about the previous day's intake, 24H recall, is commonly used in cross-sectional studies. For individual dietary assessment, a higher level of precision may be needed, and in cohorts longer periods of dietary assessment are necessary. The actual number of records needed varies between populations and their within-person variation and the between-person variation. Nelson and Bingham suggest that a 7 days record is acceptable time period for adjusting for daily variation (Nelson & Bingham, 1997), by using repeated 24H recalls or dietary diary. In this study only a few foodstuffs were asked for in a 24H recall and a 7 days recall. The women were asked to report the exact amount of each item, whereas regarding the child she was only asked to give frequencies.

Validity in dietary assessment describes the degree to which a dietary method measures what it is intended to. Even if dietary methods designed to characterize usual intakes is used it is difficult to validate because the truth is never known with absolute certainty (Gibson, 2005b). Because of a limited time frame the questionnaires used in this study were not validated before used in field. This had to be considered when analysing the intake results, and will also have to be in mind when reading them. It may be possible that the iodine intake for the women in this study not reflect the true intake of iodine for the women in the refugee camps.

To recall back the amount eaten for each of the last 7 days sets great demands of recollection and accuracy for the participants (Gibson, 2005a). Because of this the results may be unreliable. On the other hand, when comparing both of the test methods the 24H recall and the 7 days recall the results correspond quite well for the women's intakes. Correlation analyses are the most common method to measure the strength of the relationship in intakes between individuals (Gibson, 2005b). Correlating the 24H recall data with the intake per day from the 7 days recall data, there was a significant correlation for water, camel milk and goat milk intake showing strong correlation coefficients. This may indicate that the data have consistency; but the possibility of under or over estimation is still present. The median iodine intake per day from camel and goat milk was almost similar for the 24H data and the 7 days data. The water intake was a little lower per day for the 7 days data than for the 24H recall data. This may be caused by over or under estimation, or individual differences in daily intake may be reflected caused by a relatively small sample size.

One student was always present at the interviews of the participants. There were observed that the women usually had one bowl or cup for each type of drink. In most cases there was a large bowl of milk and water mixed that was drunken from by all the family members, and a smaller cup that was used by the women alone, when drinking water or soup. The women seemed to have an accurate overview of how many cups she drunk per day and how full they were and the amount of the foodstuffs were weighed by the fieldworkers. From the observations of the women and discussions with the local fieldworkers, the quantities they gave up seemed plausible. There were also very little drinks to choose between in the refugee camps, which makes it more probable that the women were able to give valid amounts of the items drunken.

The question of validity also has to be considered for the children's feeding practices and breast feeding practices. For the children's milk- and food intake, the mothers' were only asked about the frequency, which may be inaccurate compared to the "true intake".
The women may have given up wrong frequencies of foods and drinks given the last 24H and week. Even so, the 24H and 7 days data over how many times the drink or food item was given showed good correspondence for water, camel milk, goat milk and solid and semi-solid foods, which indicated a consistency of the women's answers. As there were not asked for amounts, only frequencies, this might have been easier to remember.

6.2.3 Urine and breast milk samples

The urine samples were collected as spot-urine. For populations, this is a recognised method, because it is impractical to collect 24H samples in field studies. UIC can be measured in spot urine specimens from a representative sample of the target group and expressed as the median, in micrograms per litre (WHO, 2007). A weakness of this method is that it should not be used on individual level, because of the day-to-day variation in iodine intake, and therefore also UIC. Also hydration among individuals may affect the UIC, giving higher UIC if the subject is dehydrated. Both the day-to-day variation and the hydration among individuals generally even out in a large number of samples, so that spot UIC correlates well with the UIC from 24H samples (Zimmermann, 2009). The UIC data is therefore limited to a population based estimate of iodine status.

The breast milk samples will have the same limitations at individual levels as the urine samples, and does not give individual breast milk iodine values (Dasgupta, Kirk, Dyke & Ohira, 2008). Seen as a larger group, the day-to-day variations and differences in hydration will be less actuating.

6.2.4 Processing of data and statistical analyses

The intake data of foodstuffs for the women were processed in Excel before entered into PASW. For the women who reported that they had been drinking camel and/or goat milk but did not have a sample to give a median value for camel and/or goat milk were used as iodine value. These two median iodine concentration values were calculated from all the camel milk samples (n=34) and all the goat milk samples (n=13), giving one value to use for camel milk and goat milk across camps. These median values across camps were used because two of the camps only had one or two samples, so using the median iodine concentration value within each camp from only one or two samples could give a random value rather than a valid value. Even so, the median value used for iodine intake calculation for the women who did not give a sample may not be representing the iodine value of the drunken milk, and one have to be aware that these iodine intakes is estimates. The sample iodine concentration value that was used for the women, who had given a sample, may also have been a random value not representing the true milk iodine intake over time, because of great variation in animal milk iodine concentrations. Even so, the sample milk was reported drunken during the last week by the women and will therefore correspond with the iodine excreted in urine and breast milk using the 24H data. For the water iodine intake a median value was used within each camp, giving 4 median values used for women in the 4 different camps. This was done because the variations in water iodine concentrations were high between camps but did not vary much within each camp. Also for the water iodine intake, one have to be aware that the iodine intakes is estimates, calculated on the basis of median iodine concentration values which may not have represented the true iodine intake.

Some of the distinctions in a variable may disappear when reducing the number of values when dealing with the matter of recoding (Pallant, 2005). Still recoding was considered appropriate in several cases for the statistical analyses. Recoding was used when a category had too few participants for statistical analyses and for some continuous variables to make cut offs and distinctions. Also, when the information in many categories were considered abundant the categories were merged, resulting in less categories

Regression analyses are commonly used in research reports. There is attached great significance to the analyse form, and in some cases maybe more than what is reliable (Altman, 1999). It is therefore important to be aware that one can only find variables that *probably* predict the variation in the dependent variable the most, when doing regression analyses. And the results cannot explain the cause to the variation in the variable. Multiple regression is very sensitive to outliers (Pallant, 2005), where the outliers can distort the regression results and pulls the regression line towards itself. This can result in a solution that is more accurate for the outlier, but less accurate for all of the other cases in the data set.

Outliers on the dependent variable can be defined from the standardised residual plots, where residual values between -3,3 and 3,3 is defined as acceptable (Moore, 2000). For the dependent variables used in this thesis both outliers and conditional outliers needed to be excluded in order to get acceptable residual values. Even if removal of outliers are necessary one have to have in mind that it may affect the results because it might give a different subset of cases in the final analysis.

6.3 Result discussion

6.3.1 Sample

There were 68 % of the women who were defined overweight or obese. There should be considered that the women recently had been giving birth, and therefore would have a higher BMI than usual. On the other side, the fat deposits normally increases with 4 kilos during pregnancy and the weight should be stabilized 4-6 months after birth (WHO, 1995). Taking this into consideration the mean BMI of 27 kg/m^2 still indicates a high prevalence of overweight. Also a very high prevalence of undernourishment was found among the children. Overweight adults with undernourished children is a wide spread problem in many developing countries known as the double burden of disease (WHO, 2004a).

A high prevalence of wasting and stunting among the children indicates both acute and long term under nutrition (WHO, 2006). Undernourishment is usually a problem when children are submitted to complementary foods at the age of 6 months (WHO, 2002), but as seen in this study many children are suffering from under nutrition even at a very low age. This may be caused by the great share of other foods than breast milk given to the children, suppressing the energy and nutrient dense breast milk intake. The poor feeding practises may also give an increased risk of diarrhoea which also increases under nutrition (WHO, 2002).

For some of the analyses the sample was divided into 2 areas, a high iodine area and a low iodine area, to be able to say something more specific for the different areas in order to give recommendations to the local health authorities. The name “low iodine area” can be misleading, because both of the areas showed high iodine concentrations in water, animal milk, urine and breast milk. Even so the name was used in order to separate the areas and be able to understand which area that has higher and lower iodine concentrations. There were no differences in BMI for the women between the areas. For the children there were no differences in underweight or stunting prevalence between the areas, but the wasting prevalence were higher in the low iodine area. The diarrhoea prevalence was also higher in the low iodine area than in the high iodine area and could have affected the wasting prevalence. Diarrhoea may also affect the urine samples, because dehydration may concentrate iodine in urine giving higher UI levels than normal (Zimmermann, 2008). This may therefore have given higher UIC in the low iodine area for children, which may have caused smaller differences in UIC than expected between the areas. The age distribution for both women and children were equally distributed between the areas and even if there were differences in wasting prevalence, the areas were considered quite equal.

6.3.2 Iodine concentrations in drinking water, camel milk and goat milk

The iodine concentrations in public drinking water, camel milk and goat milk were high, both for the camps in total and for each of the four camps when compared to the daily recommended iodine intake for lactating women of 250 µg/day (WHO, 2007). In the 4 camps in total the median water iodine concentration was 102 µg/L, and for the high iodine and low iodine areas the median iodine concentrations were respectively 249 µg/L and 89µg/L. In comparison to iodine concentrations in water from other countries, a study from Denmark a mildly iodine deficient country, showed that the iodine concentrations in drinking water varied between 2 µg/L to 139 µg/L, depending of the iodine content in the soil (Pedersen, Laurberg, Nøhr, Jørgensen & Andersen, 1999). A Chinese study showed variations between 56 µg/L and 462 µg/L also depending on the soil content of iodine (MU et al., 1987). Also the camel milk and goat milk iodine concentrations were very high with a median of respectively 2020 µg/L and 952 µg/L. Not much data was found for comparison of iodine concentrations in camel and goat milk in other areas, but cow’s milk iodine were shown to vary between 60 µg/L and 127 µg/L depending of the season, in a Norwegian study (Dahl, 2003). In a Spanish study the cow’s milk iodine concentration varied between 259 µg/L and 270µg/L depending of the season (Soriguer et al., 2010).

The water iodine concentrations corresponded well with findings from a previous study in the refugee camps, where the total median water iodine concentration from all the camps in total were 108µg/L. And the iodine concentrations were highest in Aaiun and Auserd (high iodine area), and lowest in Smara and Dajla (low iodine area) (SMH et al., 2008). Also the iodine concentrations in the goat milk and camel milk corresponded well with previous findings in the same area, where the median iodine concentration of goat milk were 994µg/L and 2471 µg/L in camel milk (NCA & AUC, 2011). This suggests that the findings in this present study of iodine concentrations in drinking water and animal milk may probably be valid for this area.

6.3.3 Women's urinary iodine concentration, breast milk iodine concentrations and iodine intake

Urinary and breast milk iodine concentrations

The 24H intake variables together with other factors that could have an association with UIC and BMIC were used in the preliminary regression models. The 24H intake variables for water, camel and goat milk were used, because both urine and breast milk responds quickly to dietary iodine (Dorea, 2002). Therefore it is reasonable to assume that the 24H iodine intake might be reflected in the urine and breast milk. The regression analyses show that BMI and camel milk iodine intake probably have a small association with UIC for women. In total the two independent variables explained 9,3 % of the variation of UIC. The BMIC on the other hand seems to be influenced by water iodine intake, goat milk iodine intake and UIC with a stronger association, where these independent variables probably explained 15,8 % of the variation of the breast milk iodine concentration. This means that for UIC there are 90,7 % of the variation in UIC probably not is associated with differences in BMI and goat milk iodine intake, but may be caused by other variables. For breast milk iodine concentration 84,2% of the variance is probably caused by other variables than water iodine intake, goat milk iodine intake and UIC.

An important issue in regression analyses is how good the model explains the variance in the dependent variable. The highest achievable R^2-value is 1,00 (100%) (Altman, 1999). To have a R^2-value close to the maximum value, it would be logic to include all variables with a possible explanation in the regression model. To strive for a R^2 that is as high as possible is considered poor research practise, since R^2 never decreases, but normally increases when new explanatory variables are included (Altman, 1999). Because of this phenomenon only the variables with a significant contribution to the R^2 were used in the final regression models and the results will be more likely to show a valid association. For UIC, one can see that the excretion of iodine in urine is not associated much by iodine intake for the women. Breast milk iodine on the other hand seems to be affected by the iodine intake through water and goat milk. An R^2 in this model of 15,8 % may seem small, but considering the small amount of explanatory variables included in the model it can indicate a quite good association between breast milk iodine concentrations and estimated iodine intake. The camel milk iodine intake was associated with UIC and not with BMIC, whereas goat milk iodine intake were associated with BMIC and not UIC. It is uncertain whether these associations are random, or caused by a physiological explanation. Using intake variables in regression analyses may also be challenging, because the intakes will always be estimates of the true intake (Gibson, 2005b). Overall the BMIC seems to have a stronger association with iodine intake than UIC. This is supported by an unpublished study which shows that among Saharawi women where 10 % were lactating and the rest were non-lactating, lactation seemed to be negatively associated with UIC (Henjum, Barikmo, Oshaug & Torheim, in press).

The unadjusted effects in the regression models measure the mean change in the dependent variable when the value of the independent variable increases with one unit used in simple regression. Whereas the adjusted effects measure the mean change in the dependent variable when the value of the independent variable increases with one unit while the other variables is kept constant in multiple regression analyses (Berry & Sanders, 2000). These values show the gradient on the regression line and the strength of the relation between the dependent and independent variable, but cannot be used to compare the relative strength of the independent variables between each other. For this purpose one has to use the standardised beta value (Eikemo & Clausen, 2007). The standardised beta values show that BMI has the strongest effect strength on the UIC for women. The data does not show a higher intake of iodine rich foods and drinks for the women that were overweight or obese (data not presented), but the association may be explained by the overweight or obese women having in general a higher intake of other foods and drinks that may have increased the iodine intake. On the other hand there are not found any evidence to support this theory, and in another study where UIC for non-lactating women were assessed for association with BMI they were not associated (Henjum et al., in press). For BMIC it was the water iodine intake that showed the strongest effect. This supports the theory that dietary iodine contributes more to the BMIC than the UIC for lactating women (Semba & Delange, 2001). In a study in the same area, the median UIC for women was 565 µg/L (SMH et al., 2008) for all the camps, which was much higher than the median UIC of 349µg/L in this study. In the 2008 study the women participating were non-lactating, and this may indicate that iodine is concentrated in breast milk rather than in urine. This may also explain the differences in the regression models, where iodine intake was associated with breast milk iodine concentration and not as much with UIC.

Urinary and breast milk iodine concentration in the high and low iodine area

Looking at the high iodine area and low iodine area, there are significant differences in total iodine intake, UIC and BMIC between the areas. The WHO uses a cut off of UIC < 100 µg/L as insufficient and ≥ 100 µg/L as adequate for lactating women. No institutions operate with an upper level of UIC for lactating women (SCF, 2002; IOM, 2001; WHO, 2007). There is also difficult to calculate a tolerable amount of iodine in urine based on the upper intake levels, because there is uncertain in what amounts iodine is execrated in breast milk, which affects the UIC. An upper UIC level of ≥300 µg/L is used for adults (WHO, 2007), and 58 % of the women in the study had UIC levels above this limit. In the high iodine area 74% had UIC above 300 µg/L and in the low iodine area 42% had UIC above 300 µg/L.

The median breast milk iodine concentration was 479µg/L for the four camps in total, while for the low iodine area it was 379 µg/L and 608 µg/L for the high iodine area. Several studies have shown that iodine content of breast milk correlates with dietary iodine intake, where iodine concentration in breast milk being lowest in areas of low UIC, and correspondingly higher in areas of high UIC (Bazrafshan et al., 2003; Etling et al.,1986; Moon & Kim, 1999; Ordookhani et al., 2007; Pearce et al., 2007; Pongapaew et al., 1999). Some studies also point out that the mean iodine concentration of breast milk is low in women from areas with high goitre prevalence associated with iodine deficiency (Bruhn & Frankie, 1983; Heidemann et al., 1984). In areas of iodine sufficiency a positive correlation has been seen between UIC and BMIC. In a study among Korean mothers with high iodine intake from sea weed the median iodine concentration of colostrums and mature milk was respectively 2170 µg/L and 892 µg/L (Caldwell, Jones & Hollowell, 2005; Moon & Kim, 1999). All the mentioned studies above points out that UIC may be an indicator of BMIC. Other studies show that UIC is a less reliable indicator for BMIC, where BMIC was lower than the UIC (Hannan, Faraji, Tanguame, Longoria & Rodriguez, 2009; Kung, 2007). In this study, UIC was high, and so was the BMIC, and showed a weak association with each other. Even if the UIC and BMIC showed some association, the BMIC was all over much higher than the UIC. Therefore a high UIC may indicate that the BMIC also is high, but UIC may not be a precise indicator for BMIC among women in the Saharawi refugee camps.

Iodine sources and dietary intake

The daily recommended intake of iodine for lactating women is 250 µg/day (WHO, 2007), and 74% of the Saharawi lactating women had intakes above this. In the high iodine area 91% of the women showed intakes above 250 µg/day and 56% in the low iodine area. The WHO has not established an upper intake level of iodine for lactating women (WHO, 2007). The SCF on the other hand operates with an upper intake level of 600 µg/day for adults and states that an upper level of 600 µg/day is also considered to be acceptable for pregnant and lactating women (SCF, 2002). Using this reference, in total 31% of the women had intakes above the upper level, whereas 16% in the low iodine area and 45% in the high iodine area were above 600 µg/day. A third institution, the IOM, operates with an upper level of 1100 µg/day for lactating women based on dose response tests (IOM, 2001). Using the upper level from IOM in total 10% of the women was above the upper level. There were 6% in the low iodine area showing intakes above 1100 µg/day, and 15% in the high iodine area. The number of women that exceeds the upper intake level is quite high, both when using the SCF and IOMs references. And both institutions states that thyroid disorders may occur when intakes above the respective references in exceeded. The IOMs dose response tests which the upper intake level is based on were all of short duration, and may therefore not be relevant for this study population which has been exposed to high iodine intakes for years. Also the SCF is uncertain of the effects of high iodine doses over the long term.

Looking closer into the water intake high and low iodine areas, there were no differences in total amounts water drunken between the areas. When comparing the iodine intake from water on the other hand, the iodine intake was significantly higher in the high iodine area than for the low iodine area. Since there were no differences in water intake, the differences in water iodine concentrations between the areas must have caused the differences in iodine intakes. The median iodine intake through water for both the areas was 409 µg/day. This is very high compared to a Norwegian study, where the total median iodine intake from all foods and drinks were 89 µg/day in one study population and 162 µg/day in the second study population (Dahl, Meltzer, Opsahl & Juhlshamn, 2003). But there are also studies that confirm such high iodine intakes, where iodine intake from water seemed to range between 400- 1300 µg/day (Mu et al., 1987; Zhao et al., 1998).

For the camel milk there were differences in intake and iodine intake between the areas, where the low iodine area showed both higher intake of camel milk and higher iodine intake from camel milk. This may be explained by the less variable iodine concentrations in camel milk between the areas. The goat milk showed no differences either in intake or iodine intake between the areas. In table 5-7 in the result chapter, only those who reported that they had been drinking camel and/or goat milk were included. The number of women who had been drinking camel and goat milk were quite equally distributed between the areas. Looking at the median iodine intake values from camel milk, the iodine intake shows a considerable contribution to the total intake, while for goat milk the contribution is less. There have to be considered that only half of the women reported to have been drinking camel milk, and only 19 % had been drinking goat milk. Therefore, for the total population the water intake has the largest contribution to iodine in the diet, while the camel milk and goat milk may give a strong contribution for those who drink it. This is supported by findings from the 2008 study in the same area, where water seemed to be the main contributor to iodine in the diet and local milk as the second contributor (SMH et al., 2008). But another study, also in the same area found the animal milk to be a much larger contributor to dietary iodine than what was found in this study, where 97% of the population reported to have been drinking goat milk and 76% had been drinking camel milk yesterday (NCA & AUC, 2011).

Since the water was the main source of iodine in the women’s diet, the iodine intake through water is probably the main contributor to the differences in UIC and BMIC between the two areas. Iodine rich drinking water has also been reported as a source of excess iodine intake in Chinese studies (Mu et al., 1987; Yushu et al., 2008), whereas other studies have found other sources of excessive iodine intakes, such as sea-weed and iodized salt (Caldwell et al., 2005; Moon & Kim, 1999).

Studies from China, Denmark and Iceland show that excessive iodine intakes may lead to hypothyroidism (Laurberg et al., 1998; Yushu et al., 2008). On the other hand, a population based survey has shown that differences in both hyper- and hypothyroidism is associated with small differences in iodine intake. Hypothyroidism occurred more frequently in areas of higher intakes and hyperthyroidism occurred more frequently in areas with lower iodine intakes, but both the areas had an insufficient UIC (Pedersen Bülow et al., 2002). Others have shown that large doses of iodine may not have any effect on the thyroid (Ader et al., 1988; Stocton & Thomas, 1978). Even so, high prevalence of goitre has previously been found among women and children in the Saharawi refugee camps (Henjum et al., in press), which most probably have been caused by excessive iodine intakes.

To sum up, the UIC, BMIC and iodine intakes were high both in the high and low iodine area. Water iodine intake seems to have the strongest contribution on the total iodine intake, whereas both camel milk and goat milk may be important contributors to the total iodine intake for those who drink milk. The BMIC seems to be affected more by dietary iodine than UIC. Even if the focus over the last years have been on defeating iodine deficiency, several studies also point out that excessive iodine intakes may give adverse health consequences.

6.4 Children's iodine intake and UI concentrations

6.4.1 Feeding practises and BMIC compared with children's recommended iodine intakes

The children were given much different foods and drinks which may have suppressed breast milk intake. Many children were also given animal milk containing large amounts of iodine. There is reason to believe that these varied feeding practises could be reflected in urine, and that many variables would have an association with the children's UIC. Even so, BMIC seemed to be the only variable having a significant association to the variation in UIC for the children, explaining 9,9 % of the variance. This means that 90,1 % of the variation in UIC for children is probably not explained by BMIC, and may be caused by other variables. A beta value of 0,328 shows that the effect strength of BMIC is quite strong. On the other hand the adjusted R^2 indicates that BMIC has a small contribution to the explained variance. The small R^2 may be explained by the fact that only one variable were included in the regression model. Breast milk intake as the main source of iodine for children in this age group is supported by several studies (Bazrafshan et al., 2003 Delange, 2007; Ordookhani et al., 2007). There were not found any literature supporting that children in this age group were exposed to iodine from other foods than breast milk. But looking at general feeding practises in other countries one can see that children between 0-6 years in developing countries in particular are fed much other types of foods than breast milk. Whether this foods and drinks was iodine sources for the children was not examined (WHO & UNICEF, 2010). Looking at the iodine rich drinks given the children, there were no differences between the high and low iodine areas. And there were either any difference in solid or semi-solid foods given, that could have suppressed breast milk intake, giving differences iodine intake. This means that there probably were the differences in BMIC who gave differences in the children's urine between the areas. This supports the findings from the regression analyses, showing that breast milk iodine intake is the only variable that probably has an association with the variance in the children's UIC.

The feeding practises revealed in this study did not seem to have any influence on the iodine intake among the children, and will therefore not be discussed any further. Even so, according to the child feeding indicators (WHO, 2007, 2010a, 2010b) the feeding practises among the Saharawi children was very poor and women and children in the area should be followed up.

There were 87 % of the women who breast fed their child on demand. Breast feeding on demand of the child is recommended and gives increased probability that the child gets enough breast milk (WHO, 2009). The breast feeding frequencies differed between the high and low iodine areas during night time, but no differences were seen during day time. As discussed in a previous section, the questions about breast feeding frequencies may have posed some ambiguities. And there are uncertain whether the children were breast fed more frequently in the low iodine area during the night time, or if they were sleeping at the women's breast. Since the question of breast feeding frequencies may be of different meaning in the Saharawi culture than in a Norwegian culture the differences between the high and low iodine area in breast feeding frequencies during the night time will not be emphasised here.

The WHO recommends an iodine intake of 90 µg/day for children between 0-59 months of age, while the American IOM recommends 110-130 µg/day (IOM, 2001; WHO, 2007), suggesting that the BMIC is very high compared to the children's recommended intake from all the mentioned institutions in both the high iodine and low iodine areas. When estimating the daily iodine intake from breast milk for the children, the average intake across ages were 291 µg/day for the low iodine area and 467 µg/day for the high iodine area. These intakes are both above the daily recommended intakes, from both WHO and IOM. No institutions operates with an upper intake level of iodine for children under one year's age (IOM, 2001; SCF, 2002; WHO, 2007), because of insufficient data on adverse consequences of high iodine intakes for children. But based on the recommended intake from the WHO (90 µg/day) the children from the low iodine area showed an estimated iodine intake over three times higher than the recommended intake. The children from the high iodine area showed intakes over five times higher than the recommended intake, which may indicate excessive iodine exposure.

Breast milk intake as a source of excessive iodine intakes in children are supported by other studies (Moon & Kim, 1999; Smith, Svoren & Wolfsdore, 2006). On the other hand, studies where the iodine intakes among lactating women were sufficient showed that the iodine concentration in children's urine still were to low indicating that sufficient dietary iodine for lactating women may not assure sufficient iodine nutrition through breast milk intake for the children (Bazrafshan et al., 2003; Kung, 2007).

6.4.2 UIC for children

The UIC for all the children in total was 728 µg/L, and 514 µg/L for the low iodine area and 876 µg/L for the high iodine area. The WHO does not operate with an upper limit of UIC for children in this age group, but sets an UIC of < 100 µg/L as insufficient and ≥ 100 µg/L as adequate. The upper limit for school-aged-children, also used as a reference value for the adult population is ≥ 300 µg/L, and indicates an excessive intake (WHO, 2007). For all the children in total, 89 % had UIC above this limit. In the high iodine area 98% of the children had UIC above 300 µg/L, and in the low iodine area 80% had UIC above 300 µg/L. No children had UIC below the recommended concentration of 100µg/L. The differences in UIC in the low and high iodine areas is probably not caused by differences in feeding practices, as pointed out in the previous section. The differences between the areas seems to be caused by differences in BMIC, which again may be explained by differences in iodine content of drinking water as mentioned in chapter 6.3.2.

As mentioned in the theory chapter, excessive iodine intakes may lead to goitre with its adverse health consequences. Larger thyroid volume has been found in areas with both iodine deficiency (Knudsen et al., 2000; Nygaard et al., 1993; Zimmermann, 2006) and iodine excess (Mu et al., 1987; Zaho, Chen & Maberly, 1998) and the relation between increased thyroid volume and iodine intake seems to be U-shaped (Laurberg et al., 2001). In Chinese children from two villages where the iodine concentrations in drinking water were 462 and 56 µg/L, the goitre rate was respectively 60 % and 15-20 % (Mu et al., 1987). Another study among Chinese children with drinking water iodine concentrations above 300 µg/L resulted in UIC of 900 µg/L and more, and a goitre rate above 10 % (Zaho et al., 1998). These studies suggest that that goitre and thyroid dysfunction may occur in children with iodine intakes in the range of 400- 1300 µg/day (Mu et al., 1987; Zaho et al., 1998). These findings were supported in an international cohort of children 6-12 years of age, who showed that iodine intakes above twice those recommended, indicated by urinary iodine excretion ≥ 500 µg/L, were associated with increased thyroid volume (Zimmermann, Ito, Hess, Fuijeda & Molinari, 2005). In this current study, thyroid volume was not measured and there is not possible to assess whether the children were suffering from thyroid disorders due to an enlargement of the thyroid gland. Even so, results from a previous study in the area found that 56% of the children between 6-14 years had an enlarged thyroid gland, probably caused by excessive iodine intakes (SMH et al., 2008).

7 Conclusion and implications

This chapter will contain a summarization of the most central findings in this thesis. This will be followed by some implications of the findings. Subjects for further studies will be suggested in the end of the chapter.

Conclusion

Water iodine intake seemed to have the strongest contribution on the total iodine intake for women, whereas both camel milk and goat milk may be significant contributors to the total iodine intake for those who drink milk. There were found both high UIC and BMIC among the women, and the BMIC were throughout much higher than the UIC. Further the results indicate that dietary iodine influence BMIC at a larger degree than UIC. There are not established any upper levels of UIC or iodine intake for lactating women by the WHO. But considering the daily recommended intake of iodine for lactating women of 250 µg/day (WHO, 2007) both the women's UIC and BMIC indicate a very high iodine exposure. The children's UIC seemed to only be associated with BMIC. The breast milk iodine concentrations were not favourable for children 0-7 months of age, which are recommended a daily iodine intake of 90 µg/day (WHO, 2007). The children's urinary iodine concentrations indicate that the iodine intake from breast milk is very high, with 89% of the children having a urinary iodine concentration ≥ 300 µg/L. The upper limit of ≥300 µg/L is used as a reference for an adult population by the WHO. For infants there are no upper limits developed for iodine excretion in urine, or iodine intakes.

Implications

In this study the iodine intakes among lactating women and their children were found to be very high, which may give consequences for the whole refugee population. Goitre and hypothyroidism is the most severe consequence to iodine excess (Dunn, 2000), and goitre has previously been found in 18% of the refugee women and in 11% of school-aged-children (SMH et al., 2008). Hypothyroidism caused by iodine deficiency may cause foetal damage, increased rate of child mortality, reduce children's growth and mental development and reduce reproductively (Dunn, 2000). If this also may be the consequences for iodine induced hypothyroidism is less documented, but some claim that the condition will appear in the same way for both iodine deficiency and excess (Markou et al., 2001; SCF, 2002). Considering the possible adverse health consequences of excessive iodine intakes (Dunn, 2000; WHO, 2007), the situation in the Saharawi refugee camps should be improved.

The water iodine concentrations were found in this study to be the main reason for high iodine intakes. The livestock in the camps also drink this water (Barikmo et al., in press), which probably is a large contributor to the high iodine concentrations in animal milk. One implication for improvement of the iodine situation in the camps would therefore be to purify the water for iodine in all of the camps. This may be done by reverse osmosis, which filtrates large molecules and ions (US Environmental Protection Agency, 1996). If this was achieved the drinking water would contain acceptable iodine concentrations, and animal milk iodine concentrations would probably also decrease. As a temporary solution, the most vulnerable groups; pregnant and lactating women and children, could be given bottled water, which is not containing the same quantities of iodine as the local groundwater. Putting this into action could avert severe health consequences of excessive iodine intakes among women and children.

Even if the animal milk was not the main contributor to dietary iodine in this study, it still was of significant importance to iodine in the diet for those who drank it. To recommend lactating women not to drink milk could have unfavourable nutritional consequences, especially in the refugee camps where the variety of foods and nutrients are poor. There is high iodine content in the soil in the area where the refugee camps are located, which causes the high water iodine concentrations. High iodine in soil also causes the grass and plants to have high iodine content. There should therefore be considered whether the livestock should be given fodder instead of grazing.

All over the world universal salt iodization programmes have been put into effect to defeat iodine deficiency. But over the recent years there have also been studies showing that many countries have iodine intakes that are above the recommended intakes (WHO, 2007). Based on the findings in this study, and in several other studies (Mu et al., 1987; Seal et al., 2005; SMH et al., 2008; Sun & Yang, 2009; Zaho et al., 1998) the iodine situation and the Universal Salt Iodization program should be closely monitored to avoid excessive intakes.

The WHO does not have any upper intake levels for lactating women or children less than one year’s age. The SCF and IOM have upper intake levels for lactating women, but these limits are mostly based on short-term studies. There are either any upper levels of UIC for lactating women and children less than one year by any of these institutions (IOM, 2001; SCF, 2002; WHO, 2007). Much focus has been centred on the problems of iodine deficiency, but there may also be relevant to develop recommendations for upper levels of iodine in diet and urine to be able to assess more accurate the severity of iodine excess in the long term.

Further research

There was not room for using all the data collected in field in this thesis, because of a limited time frame and the scale of the thesis. More research and results could be retrieved from this data material. This study also revealed some disquieting results regarding feeding practises and under nutrition of the children, which should be followed up by interventions and further research.

Considering the very high iodine intakes revealed for lactating women and their children in this study, a follow-up of the women and children should be done in the years to come. There would also be of importance to examine possible consequences of the high iodine intakes in the future. Since the consequences of iodine induced goitre is an area of limited documentation, there could also be of importance to assess the rate of foetal damage, child mortality, children's growth and mental development and reduce reproductively, being the known consequences of hypothyroidism mostly caused by iodine deficiency. This would be of relevance not only for the health of the refugee population, but for many other areas where iodine excess is a problem and the whole field of iodine research sciences.

8 Refrences

Ader, A. W., Paul, T. L., Reinhardt, W., Safran, M., Pino, S., McArthur, W., et al. (1988). Effect of mouth rinsing with two polyvinylpyrrolidone-iodine mixtures on iodine absorption and thyroid function. *Journal of Clinical Endocrinology & Metabolism, 66*(3), 632-635.

Altman, D. G. (1999). *Practical statistics for medical research* (9 ed.). London: Chapman & Hall/CRC.

Andersson, M., de Benoist, B., & Rogers, L. (2010). Epidemiology of iodine deficiency: Salt iodisation and iodine status. *Best Practice & Research Clinical Endocrinology & Metabolism, 24*(1), 1-11.

Azizi, F., & Smyth, P. (2009). Breastfeeding and maternal and infant iodine nutrition. *Clinical Endocrinology, 70*(5), 803-809.

Barikmo, I., Henjum, S., Dahl, L., Oshaug, A., & Torheim, L. E. (in press). Environmental implication of iodine in water; milk and other foods used in Saharawi refugees camps in Tindouf; Algeria. *Journal og Food Composition and Analysis*.

Bazrafshan, R. H., Mohammadian, S., Ordookhani, A., Abedini, A., Davoudy, R., Pearce, N. E., et al. (2003). An Assessment of Urinary and Breast Milk Iodine Concentrations in Lactating Mothers from Gorgan, Iran, 2003. *Thyroid, 15*(10), 1165-1169.

Berry, D. W., & Sanders, S. M. (Eds.). (2000). *Understanding Multivariate Research*. Oxford: Westview Press.

Bruhn, C. J., & Frankie, A. A. (1983). Iodine in Human Milk. *Journal of Dairy Science, 66*(6), 1396-1398.

Burgi, H. (2007). Excessive Iodine Intake, A short guideline. International Council for Control of Iodine Deficiency Disorders.

Burgi, H. (2010). Iodine excess. *Best Practice & Research Clinical Endocrinology & Metabolism, 24*(1), 107-115.

Bülow Pedersen, I., Laurberg, P., Knudsen, N., Jørgensen, T., Perrild, H., Ovesen, L., et al. (2006). Increase in Incidence of Hyperthyroidism Predominantly Occurs in Young People after Iodine Fortification of Salt in Denmark *Journal of Clinical Endocrinology & Metabolism, 9*(10), 3830-3834.

Caldwell, K. L., Jones, R., & Hollowell, J. G. (2005). Urinary Iodine Concentration: United States National Health and Nutrition Examination Survey (2001-2002). *Thyroid, 15,* 692-699.

Cole, J. T. (1997). Sampling, study size, and power. In M. B. Margetts & M. Nelson (Eds.), *Design Concepts in Nutritional Epidemiology*. New York: Oxford University Press.

Dahl, L. (2003). *Dietary iodine intake and status of Norwegians*. Bergen: National Institute of Nutrition and Seafood Research.

Dahl, L., Opsahl, A. J., Meltzer, M. H., Julshamn, K. (2003). Iodine intake and status in two groups of Norwegians. *Food and Nutrition Research*, *42*(4), 1654-1661.

Dasgupta, P. K., Kirk, A. B., Dyke, J. V., & Ohira, S.-I. (2008). Intake of iodine and perchlorate and excretion in human milk. *Environmental Science & Technology, 42*(21), 8115-8121.

De Groot, J. L., Larsen, R., P,, & Hennemann, G. (1996). *The Thyroid and its Diseases* (6 ed.). London: Churchill Livingstone.

Delange, F. (2007). Iodine requirements during pregnancy, lactation and the neonatal period and indicators of optimal iodine nutrition. *Public Health Nutrition, 10*(12A), 1571-1580.

Dorea, G. J. (2002). Iodine nutrition and breast feeding. *Journal of Trace Elements in Medicine and Biology, 16*, 207-220.

Dunn, T. J. (2000). Trace Element and Mineral Nutrition in Endocrine Diseases. . In D. J. Bogden & M. L. Klevay (Eds.), *Clinical Nutrition of the Essential Trace Elements and Minerals. A guide for Health Professionals.* Totowa: Humana Press.

Eikemo, A., Terje,, & Clausen, H., Tommy, (Eds.). (2007). *Kvantitativ analyse med SPSS, en praktisk innføring i kvantitative analyseteknikker.* Trondheim: tapir akademisk forlag.

Emergency Nutrition Assessment software. (2009). Retrieved 26.04.11, 2011, from http://www.smartmethodology.org/index.php?option=com_content&view=article&id=1085&Itemid=301&lang=en

Eip Info. (2011). Retrieved 09.05.11, from http://wwwn.cdc.gov/epiinfo/

Etling, N., Padovani, E., Fouque, F., & Tato, L. (1986). First-month variations in total iodine content of human breast milks *Early Human Development, 13*(1), 81-85.

European Commissions' Scientific Committee on Food. (2002). *Opinion of the Scientific Committee on Food on the Tolerable Upper Intake Level of Iodine. (expressed on 26 September 2002).* European Commission. Health and Consumer Protection Directorate General.

Food and Nutrition Board Institute of Medicine. (2001). *Reference intakes for vitamin A, vitamin k, arsenic,boron, chromium, copper, iodine, iron, manganese, molybdenum, nickel, silicon, vanadium and zinc: a report of the Panel on Micronutrients, Subcommittees on Upper Reference Levels of Nutrients and Interpretation and Uses of Dietary Reference Intakes, and the Standing Committee on the Scientific Evaluation of Dietary Reference Intakes.* Food and Nutrition Board Institute of Medicine. Washington, D.C.

Frandkin, J. E., & Wolff, J. (1983). Iodine induced thyrotoxicosis. *Medicine, 62*(1).

Gibson, S. R. (2005a). Measuring food consumption of individuals. In S. R. Gibson (Ed.), *Prinsiples of nutritional assessment* (2 ed.). New York: Oxford university press.

Gibson, S. R. (2005b). Validity in detary assessment methods. In S. R. Gibson (Ed.), *Principles of Nutritional Assessment* (2 ed.). New York: Oxford University Press.

Gibson, S. R. (2005c). Introduction. In S. R. Gibson (Ed.), *Principles of Nutritional Assessment* (2 ed.). New York: Oxford University Press.

Glinoer, D., De Nayer, P., Delange, F., Lemone, M., Toppet, V., Spehl, M., et al. (1995). A randomized trial for the treatment of mild iodine deficiency during pregnancy: maternal and neonatal effects. *Journal of Clinical Endocrinology & Metabolism, 80*(1), 258-269.

Hannan, A. M., Faraji, B., Tanguame, J., Longoria, N., & Rodriguez, C. R. (2009). Maternal milk concentration of Zinc, Iron, Selenium and Iodine and its relationship to dietary intakes. *Biological Trace Element Research, 127,* 6-15.

Health and Development Iodine Deficiency Study Group Report. *American journal of clinical nutrition, 79*(2), 231-237.

Heidemann, P. H., Stubbe, P., von Reuss, K., Schürnbrandt, P., Larson, A., & Petrykowski, W. (1984). Iodine excretion and dietary iodine supply in newborn infants in iodine-deficient regions of West Germany. *Deutche Medizinche Wochenschrift, 18*(109), 773-778.

Henjum, S., Barikmo, I., Oshaug, A., & Torheim, L. E. (in press). Iodine-induced goitre and high rates of anaemia among Saharawi refugee women. Akershus University College.

Hetzel, B. (1996). The Iodine Deficiency Disorders. In J. L. De Groot, R. Larsen, P, & G. Hennemann (Eds.), *The thyroid and its diseases* (Vol. 6). London: Churchill Livingstone.

Human Rights Watch. (2008). *Human Rights in Western Sahara and in the Tindouf Refugee Camps. Morocco/Western Sahara/Algeria*. New York: Human Rights Watch.

Hurxthal, L. M. (1945). Myxedema following iodine administration in girl aged six years. *Lahey Clinical Bulletin, 4*(73).

IBM SPSS Statistics Family. (2010). Retrieved 26.04.11, 2011, from http://www.spss.com/software/statistics/

Jooste, L. P., & Strydom, E. (2010). Methods for determination of iodine in urine and salt. *Best Practice & Research Clinical Endocrinology & Metabolism, 24*, 77-88.

Knudsen, N., Perrild, H., Christiansen, E., Rasmussen, S., Dige-Petersen, H., & Jørgensen, T. (2000). Thyroid structure and size and two-year follow-up of solitary cold thyroid nodules in an unselected population with borderline iodine deficiency. *European Journal of Endocrinology, 142*(3), 224-230.

Kung, A. (2007). Iodine nutrition for pregnant and lactating women in Hong Kong, where intake is of borderline of sufficiency. *Public Health Nutrition, 10*(12A), 1600-1601.

Laurberg, P., Pedersen, I. B., N. Knudsen, L. Ovesen, & Andersen, S. (2001). Environmental Iodine Intake Affects the Type of Nonmalignant Thyroid Disease. *Thyroid, 11*(5), 457-469.

Laurberg, P., Pedersen, M. K., Hreidarsson, A., Sigfusson, N., Iversen, E., & Knudsen, R. P. (1998). Iodine Intake and the Pattern og Thyroid Disorders: A Comparative Epidemiological Study of Thyroid Abnormalities in the Elderly in Iceland and in Jutland, Denmark. *Journal of Clinical Endocrinology & Metabolism, 83*(3), 756-769.

Lewinski, A., Zygmut, A., Karbownik-Lewinska, M., Slowinska-Klencka, D., Popowich, B., & Klencki, M. (2009). Determinal effects of increasing iodine supply: Iodine-induced hyperthyroidism, following iodine prophylaxis. In R. V. Preedy, G. Burrow, N. & R. R. Watson (Eds.), *Comperhensive handbook of iodine- nutritional, biochemical, pathological and therapeutic aspects*. London: Elsevier.

Markou, K., Georgopoulos, N., Kyriazopulou, V., & Vagenakis, A. G. (2001). Iodine-induced hypotyhroidism. *Thyroid, 11*(5), 501-510.

Moeller, C. L., Cao, X., Dumitresch, M. A., Seo, H., & Refetoff, S. (2006). Thyroid hormone mediated changes in gene expression can be initiated by cytosolic action of the thyroid hormone receptor beta through the phospatidylinositol 3-kinase pathway. *Nuclear Receptor Signaling Atlas, 4*, 1-4

Moon, S., & Kim, J. (1999). Iodine content of human milk and dietary iodine intake of Korean lactating mothers. *International Journal of Food Sciences and Nutrition, 50*, 165-171.

Moore, S. D. (2000). *The Basic Practice of Statistics* (2 ed.). New York: Freeman.

Mu, L., Chengyi, Q., Quidong, J., Eastman, J. C., Collins, K. J., Derun, L., et al. (1987). Endemic goitre in central China caused by excessive iodine intake. *Lancet, 2*, 257-259.

Nelson, & Bingham, A. S. (1997). Assessment of food consumption and nutrient intake. In M. B. Margetts & M. Nelson (Eds.), *Design Concepts in Nutritional Epidemiology* (2 ed.). New York.

Nelson, M., & Phillips, D. J. W. (1985). Sesonal veriations in dietary iodine intake and thyrotoxicosis. *Human Nutrition- applied Nutrition, 39*, 213-216.

Nelson. (1997). The validation of dietary assessment. In M. B. Margetts & M. Nelson (Eds.), *Design concepts in Nutritional Epidemiology* (2 ed.). New York: Oxford University Press.

Nordic Nnutition Recommendations. (2004.). *Nordic Nutrition Recommendations 2004, Integrating nutrition and physical activity*. Århus: Norden

Norwegian Church Aid, & Akershus University College. (2011). *A study of the Quality of Animal milk in the Saharawi Refugee Camps around Tindouf, Algeria.* Norway: Norwegian Church Aid, Akershus University College.

Norwegian Church Aid, Akershus University College, & Saharawi Ministry of Health. (2005). *Base-line and assessment study of the nutritional situation in two regions in the Saharawi Refugee Camps, Tindouf, Algeria*. Norway: Norwegian Church Aid, Akershus University College, Saharawi Ministry of Health.
Norwegian Church Aid.

Nygaard, B., Gideon, P., Dige-Petersen, H., Jespersen, N., Sølling, K., & Veje, A. (1993). Thyroid volume and morphology and urinary iodine excretion in a Danish municipality. *Acta Endocrinologica, 129*(6), 505-510.

Ordookhani, A., Pearcet, N. E., Hedayati, M., Mirmiran, P., Salimi, S., Azizi, F., et al. (2007). Assessment of thyroid function and urinary and breast milk iodine concentrations in healthy newborns and their mothers in Tehran. *Clinical Endocrinology, 67,* 175-179.

Pallant, J. (2005). *SPSS survival manual* (2 ed.). New York: Open University Press.

Pearce, N. E., Leung, M. A., Blount, C. B., Bazrafshan, R. H., He, X., Pino, S., et al. (2007). Breast Milk Iodine and Perchlorate Concentrations in Lactating Boston-Area Women. *Journal of Clinical Endocrinology & Metabolism, 95*(5), 1673-1677.

Pedersen Bülow, I., Knudsen, N., Jørgensen, T., Perrild, H., Ovesen, L., & Laurberg, P. (2002). Large Differences in Incidences of Overt Hyper- and Hypothyroidism Associated with a Small Difference in Iodine Intake: A Prospective Comparative Register-Based Population Survey. *Journal of Clinical Endocrinology & Metabolism, 87*(10), 4462-4469.

Pedersen, M. K., Laurberg, P., Nøhr, S., Jørgensen, A., & Andersen, S. (1999). Iodine in drinking water varies by more than 100-fold in Denmark. Importance for iodine content of infant formula *European Journal of Endocrinology*, *140*, 400-403.

Picciano, F., Mary,. (2000). Trace Element and Mineral Nutrition During Lactation. In D. J. Bogden & M. L. Klevay (Eds.), *Clinical Nutrition of the Essential Trace Elements and Minerals*. Totowa: Humana Press Inc.

Pongpaew, P., Tungtrongchitr, R., Vudhivai, N., Kitjaroentham, A., Intrakhao, C., Saowakhontha, S., et al. (1999). Urinary Iodine Excretion as a Predictor of the Iodine Content in Breast Milk. *Journal of Medical assosiation Thailand, 82*(3), 284-289.

Ringdal, K. (Ed.). (2001). *Enhet og mangfold, samfunnsvitenskapelig forskning og kvantitativ metode*. Oslo: Fagbokforlaget.

Ristic-Medic, D., Piskacova, Z., Hooper, L., Ruprich, J., Casgrain, A., Ashton, K., et al. (2009). Methods of assessment of iodine status in humans: a systematic review. *American Journal of Clinical Nutrition, 89* (6), 20525-20695.

Saharawi Ministry of Health, Norwegian Church Aid, & Akershus University College. (2008). *Prevalence of goitre and evaluation of food intake among Saharawi refugees in camps in Tindouf, Algeria.*: Saharawi Ministry og Health- Department of Health, Norwegian Church Aid, Akershus University College.
Saharawi Ministry of Health.

Sandström, B. (1998). Toxicity Considerations When Revising the Nordic Nutrition Recomendations. *The Joutnal of Nutrition*, *128*(2), 3725-3745.
schoolchildren: a World Health Organization/Nutrition for

Seal, J. A., Creeke, I. P., Gnat, D., Abdalla, F., & Mirghani, Z. (2005). Excess dietary iodine intake among long-tern African refugees. *Public Health Nutrition, 9*(1), 35-39.

Semba, D R., (2001). Iodine deficiency disorders. In R. D. Semba & M. W. Bloem (Eds.), *Nutrition and health in developing countries*. Totowa: Humana press Inc.

Semba, D. R., & Delange, F. (2001). Iodine in Human Milk: Perspectives for Infant Health. *Nutrition Reviews, 59*(8), 269-278.

Sharp, P. (2005). Minerals and trace elements. In G. Cathrine & P. Hilary (Eds.), *Human Nutrition* (11 ed.). London: Elsevier churchill livingstone.

Smith, C. V., Svoren, M. B., & Wolfsdore, I. J. (2006). Hypothyroidism in a breast-fed preterm infant resulting from maternal topical iodine exposure. *Journal of pediatrics, 149*, 566-567.

Soriguer, F., Gutierrez-Repiso, C., Gonzales-Romero, S., Olveria, G., Garriga, J. M., Velasco, I., et al. (2010). Iodine concentration in cows milk and its relation with urinary iodine concentrations in the population. *Journal of Clinical Nutrition*, *86(*4):1232-7.

Stocton, L. K., & Thomas, W. C. (1978). Absence of neonatal goitre during maternal use of iodinated water. *American Journal of Clinical Nutrition, 31*, 717.

Sun, F. X., & Yang, F. X. (2009). Developmental Effects of Toxic Doses of Iodine. In P. R. Victor, B. N. Gerald & R. R. Watson (Eds.), *Comperhensive Handbook of Iodine: Nutritional, Biochemical, Pathological and Therapeutic Aspects*. London: Elsevier Inc.

Teng, W., Shan, Z., Teng, X., Guan, H., Li, Y., Teng, D., et al. (2006). Effect of Iodine Intake on Thyroid Diseases in China. *New England Journal of Medicine, 354*, 2783-2793.

Todd, C. H., Allain, T., Gomo, Z. A. R., Hasler, J. A., Ndiweni, M., & Oken, E. (1995). Increase in thyrotoxicosis associated with iodine supplements in Zimbabwe. *Lancet, 346*, 1503-1504.

United Nations High Commissioner for Refugees, World Food Programme, & National Institute for Research of food and Nutrition. (2005). *Nutrition Survey Saharawi Refugee Camps Tindouf- Algeria*. Rome: United Nations High Commissioner for Refugees, World Food Programme, National Institute for Research on Food and Nutrition.United Nations Food and Agriculture Organisation.

United Nations High Commissioner for Rrefugees, World Food Programme, & Centre for International Child Health. (2002). *Anthropometric and micronutrient survey*. Algeria: United Nations High Commissioner of Refugees, World Food Programme, Centre for International Child Health- Institute of Child Health.

US Environmental Protection Agency. (1996). *Reverse Osmosis Process*. Washington: US Environmental Protection Agency.

Vander, A., Sherman, J., & Luciano, D. (2001). *Human physiology the mechanisms of body function* (8 ed.). New York: McGraw-Hill Higher Education.

Vanderpas, J. (2006). Nutritional Epidemiology and Thyroid Hormone Metabolism. *Annual Review of Nutrition, 26*, 293-322.

World Food Programme, & United Nations High Commissioner for Refugees. (2007). *UNHCR/ WFP joint assessment mission- Assistance to refugees from Western Sahara*. Rome: World Food Programme, United Nations High Commissioner for Refugees.

World Food Programme, Medicos Del Mundo, Norweigan Church Aid, & Akershus University College. (2008). *Nutritional and Food Security Survey amond the Saharawi refugees in Camps in Tindouf, Algeria October 2008.* World Food Programme, Medicos Del Mundo, Norweigan Church Aid, Akershus University College.

World Health Organisation, & United Nations Childrens Fund. (2007). *Indicators for assessing infant and young child feeding practices. Part 1 Definitions.*: World Health Organisation, United Nations Childrens Fund.

World Health Organisation, & United Nations Childrens Fund. (2010a). *Indicators for assessing infant and young child feeding practices PART 3 Countrtry prprofiles*: World Health Organization, United Nations Childrens Fund.

World Health Organisation, & United Nations Childrens Fund. (2010b). *Indicators for assessing infant and young child feeding practices. Part 2 Measurement*: World Health Organisation, United Nations Childrens Fund.

World Health Organisation. (1995). *Physical status: the use and interpretation of anthropometry*. Geneva: World Health Organisation.

World Health Organisation. (1998). *Vitamin and mineral requirements in human nutrition*. Bangkok: World Health Organisation

World Health Organisation. (2002). *Nutrient adequacy of exclusive breastfeeding for the term infant during the first six months of life.* Geneva: World Health Organization.

World Health Organisation. (2004a). Developing countries face double burden of disease. *Bulletin of the World Health Organisation, 82*(7). Geneva: World Health Organization.

World Health Organisation. (2004b). *Iodine status worldwide WHO Global Database on Iodine Deficiency*. Geneva: World Health Organization.

World Health Organisation. (2006). *WHO Child Growth Standards. Length/height-for age, weight-for -age, weight-for-length, weight-for-height and body mass index-for-age. Methods and Development*. Geneva: World Health Organisation.

World Health Organisation. (2007). *Assessment of Iodine Deficiency Disorders and Monitoring their Elimination. A guide for programme managers*: World Health

Organisation, International Council for Control of Iodine Deficiency Disorders, United Nations Children's Fund.

World Health Organisation. (2009). *Infant and young child feeding. Model Chapter for textbooks for medical students and allied health professionals.* Geneva: World Health Organisation.

World Health Organisation. (2010). WHO Child Growth Standards. Retrieved 01.07.2010, from http://www.who.int/childgrowth/standards/en/

World Health Organisation. (2011). Global Database on Body Mass Index. Retrieved 10.02.2011 from : http://apps.who.int/bmi/index.jsp?introPage=intro_3.html

Yushu, L., Teng, D., Shan, Z., Teng, X., Guan, H., Yu, X., et al. (2008). Antithyroperoxidase and Antithyroglobulin Antibodies in a Five-Year Follow-Up Survey of Populations with Different Iodine Intakes. *Journal of Clinical Endocrinology & Metabolism, 93*(5), 1751-1757.

Zhao, J., Chen, Z., & Maberly, G. (1998). Iodine rich drinking water of natural origin in China. *Lancet, 352*, 2024.

Zimmermann, M. B. (2006). The influence of iron status on iodine utilization and thyroid function. *Annual Review of Nutrition, 26*, 267-289.

Zimmermann, M. B. (2008). Methods to assess iron and iodine status. *British Journal of Nutrition, 99* (3), 2-9.

Zimmermann, M. B. (2009). Iodine deficiency. *Endocrine Reviews, 30*(4), 376-408.

Zimmermann, M. B., Hess, S. Y., Molinari, L., Benoist, d. B., Delange, F., Braverman, L. E., et al. (2004). New reference values for thyroid volume by ultrasound in iodine sufficient schoolchildren: a World Health Organization/Nutrition for Health and Development Iodine Deficiency Study Group Report. *American journal of clinical nutrition, 79*(2), 231-237.

Zimmermann, M. B., Ito, Y., Hess, S. Y., Fuijeda, K., & Molinari, L. (2005). High thyroid volume in children with excess dietary iodine intakes. *American journal of clinical nutrition, 81*(3), 840-844.

Zimmermann, M. B., Jooste, P. L., & Pandav, C. S. (2008). Iodine-deficiency disorders. *Lancet, 372*(9645), 1251-1262.

Attachment 1

The Western Sahara conflict

Western Sahara territory stretches from Morocco's southern border to Mauritania, and from the coastline of the Atlantic sea to the borders of Algeria and Mauritania.

In 1884 Spain claimed territory over the Western Sahara area, of protectorate causes. Over the next 80 years, they gradually extended their administrative control. In 1974, under pressure from the UN to decolonize, Spain agreed to conduct a referendum that would give the inhabitants of Western Sahara the option of independence. But Morocco and Mauritania did not agree to this, since they meant to have sovereignty over the area before the Spanish occupation. So in 1975 Spain signed a tripartite agreement transferring some of its powers over Western Sahara to Morocco and Mauritania. Spain formally pulled out of the territory in 1976, giving up its power over the area. Morocco and Mauritania sent their forces into Western Sahara from north and south, claiming the land. But they met opposition from the Saharawi independence movement, which had sprung out in 1973 as a resistance to the Spanish rule. They forced the Mauritanian troops to withdraw, but was soon after conquered by the Moroccan troops. Mauritania relinquished its claim over the territory in 1979, leaving all of the power to Morocco (HRW, 2008).

Already in 1976 Saharawi refugees had begun moving east towards the Algerian desert to escape the Moroccan army. By that year 50 000 Saharawi refugees had moved to refugee camps around the Tindouf area, with a lot more to come. The Saharawi independence movement's leaders founded the Saharawi Arab democratic Republic (SADR), with the goal of fighting for self-determination and national sovereignty. With help from UN a ceasefire was agreed to in 1991. With the purpose for providing a "UN Mission for the Referendum in Western Sahara" (MINURSO), where the Saharawis could decide whether they wanted independence or integration with Morocco. This vote has not yet been held, because of disagreements with voter lists with Morocco, and Morocco has refused to accept independence of the Saharawi as an option after this. The conflict solving process is still maintained, through MINURSO and UN High Commissioner for Refugees (UNHCR) (HRW, 2008, pp. 23-32; UNHCR & WFP, 2007).

Now, around 165 000 refugees are living in 4 main camps in the Tindouf area, in the Sahara desert of Algeria, named after the abandoned cities in West Sahara: El Aiune, Ausserd, Smara, and Dakla. The barren area creates problems for their living conditions, including food, nutrition and health. The Saharawis are dependent of aid to survive under the harsh living conditions, mainly provided by World Food Programme (WFP), UNHCR, European Commission for Humanitarian Aid & Civil Protection (ECHO) and different NGO's (HRW, 2008) (UNHCR, WFP, & CICH, 2002).

References:

HRW. (2008). *Human Rights in Western Sahara and in the Tindouf Refugee Camps Morocco/Western Sahara/Algeria*. New York: Human Rights Watch.

UNHCR, & WFP. (2007). *Assistance to refugees from Western Sahara*.

UNHCR, WFP, & CICH. (2002). *Anthropometric and micronutrient survey*. [Algeria]: United Nations High Commissioner of Refugees, World Food Programme, Centre for International Child Health Institute of Child Health.

Attachment 2

REPÚBLICA ÁRABE
SAHARAUI DEMOCRÁTICA

MINISTERIO DE SALUD PÚBLICA

الجمهورية العربية الصحراوية الديمقراطية

وزارة الصحة العمومية

A / Mr. Eirik Kirkerud
Chargé des Programmes (RASD)
N.C.A.

CHAHID HAFED 02/06/2010

SOLLICITUDE CONTINUATION DE LA COOPERATION ENTRE NCA ET LE POLISARIO

Permettez-moi, avant tout, de vous exprimer et a travers vous a Mr. Le secrétaire général de NCA toute notre gratitude pour le soutien généreux de votre organisation, qui a permis depuis plus de dix ans de contribuer a l'amélioration des qualités d'accueil des patients et en même temps de former un personnel dans le domaine de la nutrition.

Certes, Monsieur, le programme de nutrition des hôpitaux a permis de résoudre beaucoup de problèmes que nos moyens limites ne peuvent resoudre sachant que la population de nos camps de réfugies dépend en grande partie de l'aide humanitaire.

La réussite de ce programme se caractérise par la satisfaction des patients et de leurs familles des qualités d'accueil, la formation d'un bon nombre de nutritionniste qui veille sur la préparation et la distribution des repas pour les patients, mais aussi de superviser les différents programmes de nutrition.

Le témoignage des différents acteurs qui interviennent dans le domaine de la santé sur l'importance de ce programme pour la récupération des patients malades ou opères est clairement une reconnaissance à votre aide que nous saluons hautement.

Il est évident que notre peuple exile depuis bientôt trente ans suite à l'occupation marocaine de son territoire, est prive de ces ressources et par conséquent compte sur l'aide généreuse des organisations comme la votre pour survivre.

L'expérience fructueuse partagée depuis plus de dix ans avec votre organisation et son personnel dans l'exécution du Programme Alimentation des hôpitaux a permis de réaliser plusieurs études importantes pour notre système de santé dont nous citons spécialement la Stratégie Nationale de Nutrition, en plus des différentes études, ce qui en plus a concrétise le rôle de votre nutritionniste Mme Ingrid Barikmo comme consultante du ministère dans le domaine de la nutrition.

C'est dans ce cadre que je vous sollicite la continuité de votre programme de nutrition pour une neuvième phase et votre appui pour toutes les activités d'études nutritionnelles et de formation, tout en espérant q'une solution politique juste au conflit avec le Maroc mettra fin prochainement aux souffrances de nos réfugies.

Je tiens en cette occasion à exprimer notre reconnaissance à NCA, au gouvernement et au peuple norvégien pour sa solidarité et son soutien.

Veuillez agréer, monsieur, mes sincères considérations

Alien Abdullah
Directeur de Coopération

Attachment 3

List of participants

Overview of the number of refugees in need of aid in the Saharawi refugee camps that the UN, Polisario and Red Crescent agreed upon February 2008.03.13. Not including students abroad, people in military service, and people living in the liberated areas.

	DAIRAS	BENEF.	FAMIL.
DAJLA	B.ENZARAN	2752	559
	A. EL BEIDA	2358	474
	G. EL FULA	3048	617
	BUJDUR	2861	568
	UMDREIGA	3437	697
	EL ARGUB	2551	516
	JREIFIA	2954	587
	Subtotal	**19961**	**4018**
AAIUN	AMGALA	5 827	1371
	DCHERA	5 311	1196
	DAORA	5 959	1345
	HAGUNIA	5 543	1269
	BUCRAA	6 065	1375
	GUELTA	5 847	1312
	Subtotal	**34 552**	**7868**
AUSERD	AGUENIT	4 160	974
	TICHLA	4 519	1128
	LA GUERA	5 399	1284
	B. GANDUZ	4 654	1132
	MIYEK	4 911	1181
	ZUG	4 418	987
	Subtotal	**28 061**	**6686**
SMARA	B.LEHLU	4 345	962
	MAHBES	4 887	1095
	FARSIA	5 540	1244
	EJDEIRIA	5 584	1273
	HAUZA	5 303	1192
	TIFARITI	4 905	1143
	MHEIRIZ	4 609	1053
	Subtotal	**35 173**	**7962**
INST	"12 DE OCT"	*754*	0
	"27 DE FEB"	5 375	1134
	C. FORMACIÓN	*386*	0
	HOSP NAC	698	0
	Subtotal	**7 213**	**1134**
	Total	**124 960**	**27 668**

Attachment 4

List of participants needed from each camp and daira

Camps	DAIRAS	Beneficiaries	Participants
	B. LEHLU	4150	4
	MAHBES	4594	4
	FARSIA	5779	5
SMARA	EJDEIRIA	5675	5
	HAUZA	5291	5
	TIFARITI	4881	4
	MHEIRIZ	4998	4
	27. DE FEB	9050	8
	Subtotal	*44418*	*39*
	AGUENIT	3986	4
	TICHLA	4298	4
	LA GUERA	5350	5
AUSERD	B. GANDUZ	4548	4
	MIYEX	4750	4
	ZUG	4348	4
	Subtotal	*27280*	*25*
	B.ENZARAN	2395	2
	A. EL BEIDA	1948	2
	G. EL FULA	2647	2
DAJLA	BJUDUR	2544	2
	UMDREIGA	3000	3
	EL ARGUB	2047	2
	JREIFA	2549	2
	Subtotal	*17130*	*15*
	AMGALA	6000	5
	DCHERA	5349	5
	DAORA	6148	5
AAIUN	HAGUNIA	5690	5
	BUCHRAA	6198	6
	GUELTA	6047	5
	Subtotal	*35432*	*31*
	TOTAL	124260	110

Attachment 5

UNIVERSITETET I OSLO
DET MEDISINSKE FAKULTET

Høgskolelektor Ingrid Barikmo
Høgskolen i Akershus
Postboks 423
2001 Lillestrøm

Regional komité for medisinsk og helsefaglig forskningsetikk Sør-Øst C (REK Sør-Øst C)
Postboks 1130 Blindern
NO-0318 Oslo

Telefon: 22 84 46 67

E-post: post@helseforskning.etikkom.no
Nettadresse: http://helseforskning.etikkom.no

Dato: 21.12.2010.
Deres ref.:
Vår ref.: 2010/2513 (oppgis ved henvendelse)

Struma blant flyktninger

Vi viser til søknad om forhåndsgodkjenning av ovennevnte forskningsprosjekt. Søknaden er blitt vurdert av Regional komité for medisinsk og helsefaglig forskningsetikk i henhold til lov av 20. juni 2008 nr. 44, om medisinsk og helsefaglig forskning (helseforskningsloven) kapittel 3, med tilhørende forskrift om organisering av medisinsk og helsefaglig forskning av 1. juli 2009 nr 0955.

*Flyktninger fra Vest Sahara har siden landet ble okkupert av Marokko i 1975, vært omplassert til flyktningeleire i det sørvestlige Algerie. I dag bor ca. 165 000 flyktninger i fire leire i Tindouf provinsen; El Aiune, Ausserd, Smara og Dakla. To masterstudenter fra Høgskolen i Akershus vil i samarbeid med Kirkens Nødhjelp og på oppdrag fra myndigheter i Vest Sahara gjennomføre en kostholdsstudie i disse leirene i løpet av oktober til desember 2010. Det primære formålet med studien er å undersøke det høye inntaket av jod som er oppdaget blant flyktningene, og se hvilke konsekvenser dette har i populasjonen i leirene. Søknaden er kommet inn som en prosjektendringssøknad, og oppfattes å være en delstudie av prosjektet **Struma blant flyktninger.***

Prosjektleder: Ingrid Barikmo
Forskningsansvarlig: Høgskolen i Akershus

Saksgang
Søknaden ble først forelagt komiteen som en prosjektendringsmelding 29.09.2010. Komiteens leder vurderte endringsmeldingen på delegert fullmakt, og kom til at studieutvidelsen var å betrakte som et nytt, selvstendig prosjekt. Søker ble orientert om dette 10.11.2010. Prosjektet ble således behandlet i fullt komitémøte 06.12.2010.

Forskningsetisk vurdering
Studien skal gjennomføres i et landområde hvis status er å betrakte som uavklart, dog ikke fra norsk side. Komiteen viser til vedlagt dokumentasjon, og forutsetter at de nødvendige tillatelser fra Vest-Sahara foreligger.

Vedtak:
Prosjektet godkjennes.

Tillatelsen er gitt under forutsetning av at prosjektet gjennomføres slik det er beskrevet i søknaden og protokollen, og de bestemmelser som følger av helseforskningsloven med forskrifter.

Tillatelsen gjelder til 31.12.2012. Opplysningene skal deretter slettes eller anonymiseres, senest innen et halvt år fra denne dato. Prosjektet skal sende sluttmelding på eget skjema, jf. helseforskningsloven § 12, senest et halvt år etter prosjektslutt.

Komiteens avgjørelse var enstemmig.

Forskningsprosjektets data skal oppbevares forsvarlig, se personopplysningsforskriften kapittel 2, og Helsedirektoratets veileder for *Personvern og informasjonssikkerhet i forskningsprosjekter innenfor helse- og omsorgssektoren:*
http://www.helsedirektoratet.no/samspill/informasjonssikkerhet/norm_for_informasjonssikkerhet_i_helsesektoren_232354

Komiteens vedtak kan påklages til Den nasjonale forskningsetiske komité for medisin og helsefag, jf. Forvaltningslovens § 28 flg. Eventuell klage sendes til REK Sør-Øst. Klagefristen er tre uker fra mottak av dette brevet.

Med vennlig hilsen

Berit Grøholt (sign.)
professor dr. med.
nestleder

Tor Even Svanes
Tor Even Svanes
seniorrådgiver

Kopi: Høgskolen i Akershus v/ prorektor Olgunn Ransedokken, Pb 423, 2001 Lillestrøm

Vi ber om at alle henvendelser sendes inn via vår saksportal:
http://helseforskning.etikkom.no eller på e-post til: post@helseforskning.etikkom.no. Vennligst oppgi vårt saksnummer/referansenummer i korrespondansen.

Attachment 6

Ministrio de
Salud Publica

República Árabe
Saharaui Democrática

Consent form to participate in the iodine survey among Saharawi refugees.

We are conducting research on why the Saharawi population has a problem with goitre. This survey is a part of the Ministry of Health's work for examine and reducing this problem. If you decide to participate you and your child will be asked to contribute with:

- a sample of urine
- let us measure the throat with a special instrument looking for goitre
- measure your height and weight
- ask you questions about your food intake
- ask you questions about your background
- ask you about your family's food security situation, water sources, movements and income
- small samples of some of the food items and water, if necessary.

You and your family are randomly selected. We are asking children (boys and girls) from 0 to 12 years and females from 15 – 45 years to participate in the survey. You will be anonymous in the way that no names will be on the form where your answers are filled in. An id number will be made up just for this survey. On a separated list the doctors will keep your name and the id number, in case we find something in the tests that need treatment.

If you and your children take part in this project you help the Ministry of Health to show the world that there is a goitre problem. You also contribute to get necessary help to solve the problem for the Saharawi people. Taking part in this project is entirely up to you, and no one will hold it against you or your children if you decide not to participate. If you take part, you may stop at any time without punishment. In addition, you may ask to have your data withdrawn from the study after the research has been conducted.

The survey is a collaboration between the Saharawi Ministry of Health, Norwegian Church Aid, Akershus University College and several UN organisations. The contact person for the survey is Dr. Jahl Larad, Ministry of Health and Nutritionist Ingrid Barikmo, Norwegian Church Aid.

---***--------------***---

I agree to take part and also let my child/children take part in this project. I know what we have to do and that we can stop at any time.

____   _______________
Signature   Date

Akershus
University
College

NORWEGIAN
CHURCH AID

Attachment 7-10

Iodine survey in the Saharawi camps November-December 2010

Background questionnaire to the women

1. **Date**.. ....☐☐.☐☐.☐☐
2. **Id number woman** ....☐☐☐-☐
3. **Id number child** ....☐☐☐-☐
4. **Camp** .... ☐☐
   1=27. February, 2=Smara, 3=Auserd, 4=Dajla, 5=Aaiun
5. **Daira** (write)____☐☐
   (Daira according to a list)
6. **Barrio** (write)____☐☐
   (Barrio according to a list)

---

7. **Name of the interviewer**____
8. **Time of the interview**:........................... a) start ☐☐-☐☐ .... b) stop ☐☐-☐☐

Ask the following questions to the mother:

9. How old are you? .... ☐☐ years
10. Marital status:.. .... ☐☐
    0=Not married, 1=Married, 2=Divorced, 3=Widowed
11. Have you lived in different Saharawi refugee camps? .... ☐☐
    0=No, 1=Yes

If YES

11.1.a) Which camp________________________________ **11.1.b)** Period_______________

11.2.a) Which camp________________________________ **11.2.b)** Period_______________

11.3.a) Which camp________________________________ **11.3.b)** Period_______________

12. Have you lived in other areas outside the Saharawi refugee camps? .... ☐☐
0=No, 1=Yes

If YES

12.1.a) Which area________________________________ **12.1.b)** Period__________________

12.2.a) Which area________________________________ **12.2.b)** Period__________________

12.3.a) Which area________________________________ **12.3.b)** Period__________________

13. How long education do you have.............................. .... ☐☐
0=None, 1=Less than 6th grade, 2= 6th grade, 3=7 to 9th grade, 4=10 to 12th grade, 5=Higher education

14. Have you attended any courses in the refugee camps? .... ☐☐
0=No, 1=Yes

If YES

14.1.a) Which_____________________________________ **14.1.b)** How long______________

14.2.a) Which_____________________________________ **14.2.b)** How long______________

15. What language do you speak, read or write? (mark with X)

15.1.a) Hasanía .... **15.1.b)** speak ☐

15.2.a) Arabic................. **15.2.b)** speak ☐..........**15.2.c)** read ☐..... **15.2.d)** write ☐

15.3.a) Spanish .... **15.3.b)** speak ☐..........**15.3.c)** read ☐..... **15.3.d)** write ☐

15.4.a) Other (which?) .... **15.4.b)** speak ☐..........**15.4.c)** read ☐..... **15.4.d)** write ☐

16. Are you working outside the home at the moment? ... . ☐☐
0=No, 1=Yes

If YES

16.1 with what?____

17. How many people live in this household here and now (count those at 12october school in the area but not those that are abroad or other places in Algeria)?........................ ☐☐

18. Gender of Head of household .... ☐☐
0=Man, 1=Woman

19. Age of Head of household .... ☐☐ years

20. How many children do you have?

20.1.a) alive .... ☐☐ **20.1.b)** dead .... ☐☐

21. How many children are under 5 years?....................... .... ☐☐

97= Interviewer forgot to ask
98= Have not answered
99= Don't know

Iodine survey in the Saharawi camps November- December 2010

Breast feeding practises

1. **Date** ....☐☐.☐☐.☐☐

2. **Id number mother** ....☐☐☐-☐
3. **Id number child** ....☐☐☐-☐
4. **Camp** . ... ☐☐
   1=27.Febrero, 2= Smara, 3= Auserd, 4=Dajla, 5=Aaiun
5. **Daira** (write)____ .... ☐☐
   (According to the list)
6. **Barrio** (escribir)____

   (According to a list)

---

7. **Name of interviewer** ____

8. **Time the interview**:.................................. *a) start* ☐☐-☐☐.......... *b) stop* ☐☐-☐☐

Questions for the mother:

9. Gender of the child .... ☐☐
   0=Male, 1=Female

10. How old is the child?... .... ☐☐ months

11. When was the child born ....☐☐.☐☐.☐☐ date

12. Where was the child born... .... ☐☐
    1= At home, 2=In dispensario, 3= hospital in the camp, 4=Hospital in Rabouni, 5= Hospital in Tindouf

13. What was the weight of the child when it was born?..... ....☐☐☐☐ grams
    13.1. Is the weight given verbal of from health card? .... ☐☐
    0= Verbal, 1= Health card

14. How long was the baby when it was born?................... .... ☐☐ cm
    14.1. Is the height given verbal or from health card? .... ☐☐
    0=Verbal, 1= Health card

15. Have your child had diarrhoea during the last two weeks?.. ☐☐
    0= No, 1= Yes

16. Have your child have any other disease during the last two weeks? .... ☐☐
    0=No, 1=Yes
    If yes: Which? (write)____

97= Interviewer forgot to ask
98= Have not answered
99= Don't know

17. Have you given any medicine to your child the last two weeks? .... ☐☐
0=No, 1=Yes

If Yes: What kind of medicine?

17.1. Nature medicine... .... ☐☐
0=No, 1=Yes
If yes: What type of medicine? (write)___________________________________
17.2. Hospital/ doctors medicine .... ☐☐
0=No, 1=Yes
If yes: What kind of medicine? (write)_____________________________________

18. How long time after birth did you start breast feeding this child?............................... ☐☐
1=within the first hour, 2=within the first 6 hours, 3=within the next 6 hours (the first day), 4=within the second day, 5=within the third day, 6=other (How long)___________________

19. Did you give your child anything else to drink than breast milk, before you started breastfeeding it for the first time? .... ☐☐
0=No, 1=Yes

If yes: What did you give?

19.1. Sugar water .... ☐☐
0=No, 1=Yes
If yes:
19.1.1. What kind of water .... ☐☐
1=Public water, 2=bottled water, 3=from my own well
19.1.2. Did you boil the water before giving it?...... .... ☐☐
0=No, 1= Yes

19.2. Oil water .... ☐☐
0=No, 1=Yes
If yes:
19.2.1. What kind of water? .... ☐☐
1=Public water, 2=bottled water, 3=from my own well
19.2.2. Did you boil the water before giving it?...... .... ☐☐
0= No, 1= Yes

19.3. Milk or milk mixed with water............................. .... ☐☐
0=No, 1=Yes
If yes:
19.3.1. What type of milk did you give? .... ☐☐
1=Goat milk, 2= Camel milk, 3= Candia milk, 4=Formula
19.3.2. Did you boil the milk or mix before giving it?... ☐☐
0= No, 1= Yes

19.4. Other drink, what? (write)____

20. How do you usually breastfeed your child .... ☐☐

97= Interviewer forgot to ask
98= Have not answered
99= Don't know

1=on demand, 2=at fixed intervals, 3=both

21. How many times during the DAY yesterday did you breast feed your child?.............. ☐☐
0= no times, 1=1-5 times, 2= 6-10 times, 3=11-15 times, 4=All the time

21.1. Was this a normal day? .... ☐☐
0=No, 1=Yes

If no:

21.1.1. Why not? (Write)____

21.1.2. How many times would you breast feed your child on a normal day? .... ☐☐
0= no times, 1=1-5 times, 2= 6-10 times, 3=11-15 times, 4=All the time

22. How many times during the NIGHT to today did your breast feed your child?.......... ☐☐
0= no times, 1=1-5 times, 2= 6-10 times, 3=11-15 times, 4=All the time

22.1. Was this a normal night? .... ☐☐
0=No, 1=Yes

If no:

22.1.1. Why Not (Write)____

22.1.2. How many times would you breast feed your child on a normal night?..... ☐☐
0= no times, 1=1-5 times, 2= 6-10 times, 3=11-15 times, 4=All the time

97= Interviewer forgot to ask
98= Have not answered
99= Don't know

<u>Tell the mother this:</u> There will now be a section with questions about foods and drinks you might have given your child. First we ask about how many times *yesterday* you gave the certain food or drink. Yesterday means the 24 hours from your child woke up yesterday morning until it woke up today. If you did not give that food or drink yesterday, you can answer no times. Than we ask about how many times the last week, 7 days and nights, you gave the food or drink. If you did not give the food or drink the last week you answer no times and we go to the next food question. Please try to remember back as accurate as possible.

To the nutritionists: You have to ask the mother about how many times, during the last 24 hours yesterday, she gave food or drinks. And write down this answer. Then you ask about the last week, and write this answer down. The 24 hours is separated from the week, and should not be included in the answer.

23. How many times did you give your child any of the following foods and drinks:

Sugar water
23.1. Times yesterday (day and night) .... ☐☐ times
23.2. Times the last week (7 days and nights)................. .... ☐☐ times
If yes:
23.2.1. What kind of water .... ☐☐ water
1=Public water, 2=bottled water, 3=from my own well
23.2.2. The last time you gave sugar water, did you boil the water before giving it?☐☐
0= No, 1= Yes

Oil water
23.3. Yesterday, during the day and night(24 hours) .... ☐☐ times
23.4. Times the last 7 days AND nights (week)............. .... ☐☐ times
If yes:
23.4.1. What kind of water .... ☐☐ water
1=Public water, 2=bottled water, 3=from my own well
23.4.2. The last time you gave oil water, did you boil the water before giving it? ☐☐
0= No, 1= Yes

Formula
23.5. Yesterday, during the day and night (24 hours) .... ☐☐ times
23.6. Times the last 7 days AND nights (week).............. .... ☐☐ times
If yes:
23.6.1. What kind of water .... ☐☐ water
1=Public water, 2=bottled water, 3=from my own well
23.6.2. The last time you gave formula, did you boil it before giving it? .... ☐☐
0= No, 1= Yes

97= Interviewer forgot to ask
98= Have not answered
99= Don't know

Goat milk or goat milk mixed with water

23.7. Times yesterday (the day and night)....................... .... ☐☐ times

23.8. Times the last week (7 days and nights)................. .... ☐☐ times

If yes:

23.8.1. The last time you gave goat milk or mixed goat milk, did you boil it before giving it?.. .... ☐☐

0= No, 1= Yes

Camel milk or camel milk mixed with water

23.9....... Times yesterday (the day and night)................. .... ☐☐ times

23.10. .. Times the last week (7 days and nights)........... .... ☐☐ times

If yes:

23.10.1. The last time you gave camel milk or mixed camel milk, did you boil it before giving it?.. .... ☐☐

0= No, 1= Yes

Cadida milk or cadida milk mixed with water

23.11. .. Times yesterday (the day and night) .... ☐☐ times

23.12. .. Times the last week (7 days and nights)........... .... ☐☐ times

If yes:

23.12.1 The last time you gave cadida milk or cadida milk mixed with water, did you boil it before giving it? .... ☐☐

0= No, 1= Yes

Dates

23.13. .. Times yesterday (the day and night) .... ☐☐ times

23.14. .. Times the last week (7 days and nights)........... .... ☐☐ times

Soup

23.15. .. Times yesterday (the day and night) .... ☐☐ times

23.16. .. Times the last week (7 days and nights)........... .... ☐☐ times

Porridge

23.17. .. Times yesterday (the day and night) .... ☐☐ times

23.18. .. Times the last week (7 days and nights)........... .... ☐☐ times

Bread

23.19. .. Times yesterday (the day and night) .... ☐☐ times

23.20. .. Times the last week (7 days and nights).......... .... ☐☐ times

Eggs

23.21. .. Times yesterday (the day and night) .... ☐☐ times

23.22. .. Times the last week (7 days and nights)........... .... ☐☐ times

Vegetables *(for example: carrot, potato, onion, tomatoes, etc.)*

97= Interviewer forgot to ask
98= Have not answered
99= Don't know

23.23. .. Times yesterday (the day and night) .... ☐☐ times
23.24. .. Times the last week (7 days and nights)........... .... ☐☐ times
If yes, what kind (write)____

Fruits *(for example: banana, orange, apples, pears, etc.)*
23.25. .. Times yesterday (the day and night) .... ☐☐ times
23.26. .. Times the last week (7 days and nights)........... .... ☐☐ times
If yes, what kind (write)____

Juice
23.27. .. Times yesterday (the day and night) .... ☐☐ times
23.28. .. Times last week (7 days and nights)................. .... ☐☐ times

Sweets *(for example: muffins, biscuits, etc.)*
23.29. .. Times yesterday (the day and night) .... ☐☐ times
23.30. .. Times the last week (7 days and nights)........... .... ☐☐ times

Lenses
23.31. .. Times yesterday (the day and night) .... ☐☐ times
23.32. .. Times the last week (7 days and nights)........... .... ☐☐ times

Rice
23.33. .. Times yesterday (the day and night) .... ☐☐ times
23.34. .. Times the last week (7 days and nights)........... .... ☐☐ times

Other, what (write)____
23.35. .. Times yesterday (the day and night) .... ☐☐ times
23.36. .. Times the last week (7 days and nights)........... .... ☐☐ times

24. How old was the child when you first introduced it to solid or semi-solid foods, like bread, rice, fruit, porridge, etc? .... ☐☐ months

25. How old will the child be when you plan to stop breast feed it? .... ☐☐ months

26. Did you eat like normal when you were pregnant with this child?.............................. ☐☐
1=Yes, 2=I ate more, 3= I ate less

27. Did you go to controls at the health centres or hospitals when you were pregnant with this child.... .... ☐☐
0=No, 1=Yes
27.1. If yes: How many times .... ☐☐ times

97 = Forgot to ask
98 = Not answered
99 = Do not know

Iodine survey in the Saharawi camps November – December 2010

24 hour and 7 days recall on milk and water intake among women

1. **Date** ....☐☐.☐☐.☐☐
2. **Id number woman** ....☐☐☐-☐
3. **Id number child** ....☐☐☐-☐
4. **Camp** . ... ☐☐
   1=27.February, 2=Smara, 3= Auserd, 4=Dajla, 5=Aaiun
5. **Daira** (write)____☐☐
   (Daira according to a list)
6. **Barrio** (write)____ ☐☐
   (Barrio according to a list)

---

7. **Name of the interviewer**____
8. **Time of the interview**: .... a) start ☐☐-☐☐ .... b) stop ☐☐-☐☐

Information to the mothers (read): In this questionnaire, we will ask you about your consumption of milk, water, tea and soup during the last 7 days and yesterday is the last 24 hours, which refer to food and drink consumed from the time you woke up yesterday until the time you woke up today. We will start with milk and continue with the other foods and drinks.

MILK

9. Did you drink any of the following milk types the last 7 days? (Ask all milk types)

9.1 Goat milk .... ☐☐

0=No, 1=Yes

9.2 Camel milk .... ☐☐

0=No, 1=Yes

9.3 Candia milk .... ☐☐

0=No, 1=Yes

9.4 Powder milk .... ☐☐

0=No, 1=Yes

9.5 Other milk .... ☐☐

0=No, 1=Yes

<u>If NO</u> on all the questions above, go to Question 30.

<u>If YES</u> on any of the questions above, continue with the questions according to the milk type they have consumed (10-29).

Goat milk

10. How was the distribution of milk and water?................ □□□□ gram milk □□□□ gram water

11. How much goat milk did you drink in total pr. day each of the last 7 days?

a) Yesterday (Day 1) .... □□□□ gram

b) Day before yesterday (Day 2) .... □□□□ gram

c) Day 3 .... □□□□ gram

d) Day 4 .... □□□□ gram

e) Day 5 .... □□□□ gram

f) Day 6 .... □□□□ gram

g) Day 7 .... □□□□ gram

12. Where did you get the goat milk? .... □□

*1=From my own household, 2=I bought it/got it (**Note**:Use the day that is coming first on the list of days)*

If you bought it/got it,

12.1 Where did you buy/get the goat milk? (write)________________________________

13. Is this the amount of goat milk you usually drink in a week?...................................... □□

0=No, 1=Yes

If NO,

13.1 Why not? (write)____

Camel milk

14. How was the distribution of milk and water?............... ☐☐☐☐ gram milk ☐☐☐☐ gram water

15. How much camel milk did you drink in total pr. day each of the last 7 days?

a) Yesterday (Day 1) .... ☐☐☐☐ gram

b) Day before yesterday (Day 2)................................. .... ☐☐☐☐ gram

c) Day 3 .... ☐☐☐☐ gram

d) Day 4... .... ☐☐☐☐ gram

e) Day 5 .... ☐☐☐☐ gram

f) Day 6... .... ☐☐☐☐ gram

g) Day 7 .... ☐☐☐☐ gram

16. Where did you get the camel milk? .... ☐☐

*1=From my own household, 2=I bought it/got it (**Note**:Use the day that is coming first on the list of days)*

If you bought it/got it,

15.1 Where did you buy/get the camel milk? (write)________________________________

17. Is this the amount of camel milk you usually drink in a week? .... ☐☐

0=No, 1=Yes

If NO,

16.1 Why not? (write)____

Candia milk

18. How was the distribution of milk and water?............... ☐☐☐☐ gram milk ☐☐☐☐ gram water

19. How much Candia milk did you drink in total pr. day each of the last 7 days?

a) Yesterday (Day 1) .... ☐☐☐☐ gram

b) Day before yesterday (Day 2) .... ☐☐☐☐ gram

c) Day 3 .... ☐☐☐☐ gram

d) Day 4 .... ☐☐☐☐ gram

e) Day 5 .... ☐☐☐☐ gram

f) Day 6 .... ☐☐☐☐ gram

g) Day 7 .... ☐☐☐☐ gram

20. Where did you get the Candia milk? .... ☐☐

*1=From my own household, 2=I bought it/got it (**Note**:Use the day that is coming first on the list of days)*

If you bought it/got it,

19.1 Where did you buy/get the Candia milk? (write)________________________________

21. Is this the amount of Candia milk you usually drink in a week? .... ☐☐

0=No, 1=Yes

If NO,

20.1 Why not? (write)____

Powder milk

22. How was the distribution of milk and water?................ ☐☐☐☐ gram milk ☐☐☐☐ gram water

23. How much powder milk did you drink in total pr. day each of the last 7 days?

a) Yesterday (Day 1) .... ☐☐☐☐ gram

b) Day before yesterday (Day 2) .... ☐☐☐☐ gram

c) Day 3 .... ☐☐☐☐ gram

d) Day 4 .... ☐☐☐☐ gram

e) Day 5 .... ☐☐☐☐ gram

f) Day 6 .... ☐☐☐☐ gram

g) Day 7 .... ☐☐☐☐ gram

24. Where did you get the powder milk? .... ☐☐

*1=From my own household, 2=I bought it/got it (**Note**:Use the day that is coming first on the list of days)*

If you bought it/got it,

23.1 Where did you buy/get the powder milk? (write)______________________________

25. Is this the amount of powder milk you usually drink in a week?................................. ☐☐

0=No, 1=Yes

If NO,

24.1 Why not? (write)____

Other milk

26. How was the distribution of milk and water?................ ☐☐☐☐ gram milk ☐☐☐☐ gram water

27. How much other milk did you drink in total pr. day each of the last 7 days?

a) Yesterday (Day 1) .... ☐☐☐☐ gram

b) Day before yesterday (Day 2)................................. .... ☐☐☐☐ gram

c) Day 3 .... ☐☐☐☐ gram

d) Day 4... .... ☐☐☐☐ gram

e) Day 5 .... ☐☐☐☐ gram

f) Day 6... .... ☐☐☐☐ gram

g) Day 7 .... ☐☐☐☐ gram

28. Where did you get the other milk? .... ☐☐

*1=From my own household, 2=I bought it/got it (**Note**:Use the day that is coming first on the list of days)*

If you bought it/got it,

27.1 Where did you buy/get the powder milk? (write)______________________________

29. Is this the amount of other milk you usually drink in a week? .... ☐☐

0=No, 1=Yes

If NO,

28.1 Why not? (write)____

WATER

30. Did you drink water the last 7 days? .... ☐☐

0=No, 1=Yes

If NO, go to Question 34.

If YES, continue with the questions below.

31. How much water did you drink in total pr. day each of the last 7 days?

a) Yesterday (Day 1) .... ☐☐☐☐ gram

b) Day before yesterday (Day 2) .... ☐☐☐☐ gram

c) Day 3 .... ☐☐☐☐ gram

d) Day 4 .... ☐☐☐☐ gram

e) Day 5 .... ☐☐☐☐ gram

f) Day 6 .... ☐☐☐☐ gram

g) Day 7 .... ☐☐☐☐ gram

32. From where did you get the drinking water .... ☐☐

*1= Public water, 2= Water from own well, 3= Sweet water, 4= Bottled water, 4= Other water (**Note**: Use the day that is coming first on the list of days)*

33. Is this the amount of water you usually drink in a week? .... ☐☐
0=No, 1=Yes

If NO,

33.1 Why not? (write)____

TEA

34. Did you drink tea the last 7 days? .... ☐☐

0=No, 1=Yes

If NO, go to Question 38

If YES, continue with the questions below.

35. How much tea did you drink in total pr. day each of the last 7 days?

a) Yesterday (Day 1) .... ☐☐☐☐ gram

b) Day before yesterday (Day 2) .... ☐☐☐☐ gram

c) Day 3 .... ☐☐☐☐ gram

d) Day 4 .... ☐☐☐☐ gram

e) Day 5 .... ☐☐☐☐ gram

f) Day 6 .... ☐☐☐☐ gram

g) Day 7 .... ☐☐☐☐ gram

36. From where did you get the tea water .... ☐☐

*1= Public water, 2= Water from own well, 3= Sweet water, 4= Bottled water, 4= Other water (**Note**: Use the day that is coming first on the list of days)*

37. Is this the amount of tea you usually drink in a week? .. .. ☐☐

0=No, 1=Yes

If NO,

37.1 Why not? (write)____

SOUP

38. Did you eat soup the last 7 days? .... □□

0=No, 1=Yes

If YES, continue with the questions below.

39. How much soup did you eat in total pr. day each of the last 7 days?

a) Yesterday (Day 1) .... □□□□ gram

b) Day before yesterday (Day 2) .... □□□□ gram

c) Day 3 .... □□□□ gram

d) Day 4 .... □□□□ gram

e) Day 5 .... □□□□ gram

f) Day 6 .... □□□□ gram

g) Day 7 .... □□□□ gram

40. Is this the amount of soup you usually eat in a week? ... . □□

0=No, 1=Yes

If NO,

39.1 Why not? (write)____

Thank you for your time and for answering our questionnaires ☺

97 = Forgot to ask
98 = Not answered
99 = Do not know

Iodine survey in the Saharawi camps November – December 2010

Samples and measurements of mother and child

1. **Date** ....☐☐.☐☐.☐☐
2. **Id number woman** ....☐☐☐-☐
3. **Id number child** ....☐☐☐-☐
4. **Camp** . ...☐☐
   1= 27.February, 2=Smara, 3= Auserd, 4=Dajla, 5=Aaiun
5. **Daira** (write)____☐☐
   (Daira according to a list)
6. **Barrio** (write)____☐☐
   (Barrio according to a list)

Anthropometric measurements

7. What is the weight of the mother? ....☐☐,☐ kg
   7.1 What is the weight of the clothes ☐ ½ kg, ☐ 1 kg, ☐ 2 kg
8. What is the height of the mother? ....☐☐☐,☐ cm

9. What is the weight of the child? ....☐☐,☐ kg
10. What is the height of the child? ....☐☐☐,☐ cm

Urine samples

11. Is urine sample from the mother collected? ....☐☐
    0=No, 1=Yes
12. Is urine sample from the child collected? ....☐☐
    0=No, 1=Yes

Blood samples

13. Is blood sample from the mother collected? ....☐☐
    0=No, 1=Yes
14. Is blood sample from the child collected? ....☐☐
    0=No, 1=Yes

Breast milk sample

15. Is breast milk sample from the mother collected? .... ☐☐

0=No, 1=Yes

Water samples

16. Are water samples from the household collected? .... ☐☐

0=No, 1=Yes

Animal milk samples

17. Are animal milk samples from the household collected? .... ☐☐

0=No, 1=Yes

If YES,

18. How many milk samples are taken from the household? .... ☐☐

18.1 Where is the origin of the milk sample 1? .... ☐☐

1=The camp, 2=The liberated area, 3= Other

18.2 Where is the origin of the milk sample 2? .... ☐☐

1=The camp, 2=The liberated area, 3= Other

Questionnaires

19. Is Questionnaire 1 – Background information, filled out? .... ☐☐

0=No, 1=Yes

20. Is Questionnaire 2 – 24 hour and 7 days recall, filled out?.. ☐☐

0=No, 1=Yes

21. Is Questionnaire 3 – Breastfeeding practices, filled out? .... ☐☐

0=No, 1=Yes

Attachment 11-12

Protocol

Background

We are doing research on why the Saharawi population has a problem with goitre. This survey is a part of the Ministry of Health's work for examine and reducing this problem. The main objective for the project is to examine the iodine status among lactating women and their children aged 1-6 months, in the 4 refugee camps of Tindouf. We specifically want to examine the iodine intake among mothers, their iodine excretion in urine, and if high iodine intake for the mothers will give high level of iodine in breast-milk. And further if this is affecting the children's thyroid function and iodine concentration in urine.

To give answers to these questions we need no collect data from both the mothers and their children. We want to collect data about:

From women

1. Urinary iodine excretion.
2. Iodine concentration in breast-milk.
3. Iodine intake.
4. Breast-feeding practices.
5. Serum levels of TSH, T4, thyroglobulin and anti-TPO.
6. Anthropometrical measurements.

From children

1. Urinary iodine excretion.
2. Serum levels of TSH, T4, thyroglobulin and anti-TPO.
3. Anthropometric measurements.

Other

1. Iodine concentration in animal milk samples from each household.
2. Iodine concentration in waters samples of public water from each camp.

How to accomplish the objectives:

1) To examine the excretion of iodine in urine from mothers and children we will need a <u>urine sample</u> from each.

2) The iodine concentration in breast milk we want to have one breast milk sample from each mother.
3) To examine the serum levels of TSH, T4, thyroglobulin and anti-TPO, we want a blood sample from both the mother and the child.
4) To examine the iodine concentrations in animal milk, we want a sample of the animal milk in each household where the mother or child have been drinking animal milk.
5) To examine the iodine concentrations in the drinking water we want a water sample of the public water from each camp
6) Background variables from the mothers will be collected through a questionnaire 1 called “Background information”.
7) The iodine intake of the children and background variables for the children will be collected through a questionnaire 2 called “Breast feeding practises”.
8) The iodine intake among the mothers will be collected in a questionnaire 3 called “iodine intake women”.
9) The last questionnaire 4 called “samples and measurements” should be used to mark of for each of the samples collected, urine, blood, the other questionnaires etc. In addition the anthropometrical measures should be written in this questionnaire.

Sample size

The study design will be a cohort, where there will be a follow-up after 2 and 5 years, if the refugee situation is unchanged. The study conducted now will be the basline of the cohort.

Lactating women with infants from 1- 6 months of age will be selected from the four camps. This is intended to be done through the health stations in the camps. There are approximately 5-6 health stations in each camp, where we hope lists of women with infants under 6 months will be provided. Through the lists, women and their child will be randomly selected.

We have calculated that the sample size should consist of 100 women and 100 children. To account for drop-outs at the follow-up studies, 10% have been added to the calculated sample, the total sample size will therefore be 110 women and 110 children.

Fieldwork

The data will be collected by 2 teams, one team with Navnit in cooperation with a nutritionist, and another team with Inger and a nutritionist. The two teams will go from household to household and collect all the data, except from the blood samples. We hope to be able to collect data from 3 households pr team pr day, in total 6 households pr day. We will try to finish in one camp before we move to the next. The blood samples will be taken from all the participants in a camp when all of the other data collection is finished there. So when we are finished in a camp one or two days will be used to drive the women with their children to the hospital to take blood samples from them.

Each afternoon one team will have to drive around to the participants that has been chosen to participate the next day. We only want women who are lactating their children, so you have to ask them if they do so. If they are lactating, they will be informed of the study and asked if they want to participate. You have to give the women the consent letter so they can read it. If they cant read you have to read it for them. If the women are sure that they and their child wants to participate they have to sign the letter. If they are not able to sign another person in the household or a friend can do it for them.

For the lactating women who wants to participate we deliver out a urine bag for the child to use for collecting urine samples, and two glasses. We will ask them to have a urine sample ready, from both the women and the child when we come back the next day. We will also deliver out a breast pump that the woman can collect breast milk in before we come the next day. We also deliver out a tube, that she must pour the milk over to after pumping. The tube has a screw cap, and it is very important that the woman attaches the screw cap onto the tube after pouring over the milk. If she doesn't want to use the pump, she can disconnect the container from the pump and manually give a sample in the container, or directly into the tube.

Data collection

Urine samples

1) The fieldworkers will go to the participating mothers' home in the evening, a day before the survey, to hand out one urine cup for the mother to use, and one urine bag and a urine cup for the mothers to use on their children to collect urine samples from them.

2) The mothers should give a urine sample from themselves in the urine cup and receive instructions from the fieldworkers on how to use the urine bags on their children, so they can hand in a urine sample from the children too. The urine bags should not be contaminated with faeces.

3) After applying the urine bags on the children, the mother should pour the urine collected in the urine bags over to the urine cups, which the women have received.

4) At least 1 ml of urine will be required from the mothers and children.

5) The urine cups will be collected by the fieldworkers the day of the survey, when height and weight will be measured and questionnaires asked.

6) The urine samples will be transferred to tubes, which will be tightly sealed and stored in cooling temperatures until analyzed.

Breast milk sample

The women will deliver us the breast milk she has already pumped, in the tubes. If she has not given any milk yet, we want her to give while we are there to collect the other data.

Blood samples

1) The mothers and children will in due time be transported to the hospitals in each camp to give blood samples. The blood samples will be transported to Rabouni.

2) One health professional will be responsible for taking blood samples of the mothers and one will be responsible for taking blood samples of the children. The health professionals should be qualified to take blood samples.

3) Sterile equipment should be used and the health professional must always wear gloves before taking the blood sample.

4) 4ml of blood (which gives 2 ml of serum) should be collected from each participant.

5) When a blood sample is taken it should be turned 8-10 times before it is left to rest for 30 minutes.

6) If the blood collected in the tube is only half full, it is important to open the tube for a few seconds before it is turned 4-5 times and then left to rest.

7) The blood sample should preferably be centrifuged within 2 hours. However, it can be centrifuged within 5 hours, but it should say on the sample how long it was left to rest before it was centrifuged, as it may affect the results.

8) The centrifuge should have strength between 1100 and 2000, preferably at 1500. It is important to have a balanced amount of tubes within the centrifuge. The blood samples should be centrifuged for 10 minutes.

9) When the blood samples have been centrifuged, the serum will be on the top of the tube. By using a pipette, the serum should be transferred over to a new tube. Remember to use a new pipette for each blood sample.

10) After transferring the serum, the tube should be sealed and labeled correctly according to the ID numbers of the participants.

11) The serum has to be stored at -20°C until transported to Norway.

12) The serum should be transported in cooling bags back to Norway.

Animal milk sample

We take animal milk samples from the households where the women or children have been drinking animal milk. We want samples from the same milk the mother have been dirking or the child has been drinking. If they have been drinking several types of milk over the last 7 days, we want one sample from each of the milk types. If they only have been drinking one milk type over the last 7 days, we only want one sample of that milk.

Water sample

We want 3 water samples from the public water of each camp. If the women reports that they have gotten their water from a private well, we want to take a sample from the well too.

Questionnaires 1-4

1) The fieldworkers will go to the homes of the participants to complete the questionnaires. The mother, who is the participant in the study, will be asked to answer the questions asked by the fieldworker.

2) The fieldworker will begin with the background questionnaire to collect background information of the participant in the right order of the questions.

3) After the background questionnaire, the fieldworker should continue with dietary questionnaire for iodine intake. It is important that the fieldworker explains the questionnaire to the participants. 24 hour recall includes the intake from the time the participant work up yesterday until the time the participant woke up today. 7 days recall includes the last 7 days and nights.

4) The dietary questionnaire begins with the intake of milk (goat, camel, cadida, powder and other milk). The participant should say if she drunk any of these milk types and the fieldworker should continue with the follow up questions for milk types according to the types which has been drunk by the participant. If no milk has been consumed, the fieldworker should jump over and continue with the question for water and so on.

5) The participant should herself show how much she drank or ate of the different drinks and foods. The participant may use cups and measurements which makes it easy for her to measure the amount. The amount will be transferred over to a scale and be measured in grams.

6) The breast feeding questionaire is the last of the questionaires. The field worker ask the mother about her baby and how she feeds it. The questionaire contains questions about breastfeeding practises, and fod and drink intake of the baby over the last 24 hours and 7 days. In this questionaire, no amounts will be measured, only how many times the food or drink was given. It is important to be patient and let the mother try to remember back as acurate as possible.

Anthropometric measurements

1) Height and weight will be measured from both the mother and her child.

2) A height scale to the neares mm will be used to measure the mother and child. The mother should stand straight on to a wall with her heels, shoulders and head toutching the wall, while looking straight ahead. The child should be measured lying down on a bench streched out.

3) The mother will be asked to standt on a digital weight scale to measure her weight to the nearest gram. She should take of her shoes and wear as little heavy clothes as possible. If she is wearing a lot of clothes, it should be written down, so the weight of the clothes can be taken away from the total weight. The weight of the mother should be noted befor giving her the child on the weight scale, so the weight of the child can be known from the increase on the weight scale.

Antecedentes

Estamos haciendo la investigación sobre por qué la población saharaui tiene un problema con el bocio. Esta encuesta forma parte del Ministerio de Salud de trabajo para analizar y reducir este problema. El objetivo principal del proyecto es examinar el nivel de yodo en las mujeres lactantes y sus niños de 1-6 meses, en los 4 campos de refugiados de Tinduf. En especial, queremos examinar la ingesta de yodo entre las madres, su excreción de yodo en la orina, y si la ingesta de yodo de alta a las madres que dan de alto nivel de yodo en la leche materna. Y más si se trata de afectar la función tiroidea de los niños y la concentración de yodo en la orina.

Para dar respuestas a estas preguntas que no necesitan recoger datos tanto de las madres y sus hijos. Queremos recoger datos sobre:

De las mujeres:

1) La excreción urinaria de yodo.
2) Concentración de yodo en la leche materna.
3) La ingesta de yodo.
4) Prácticas de lactancia.
5) Los niveles séricos de TSH, T4, tiroglobulina y anti-TPO.
6) mediciones antropométricas.

De los niños:

1) la excreción urinaria de yodo.
2) Los niveles séricos de TSH, T4, tiroglobulina y anti-TPO.
3) Las mediciones antropométricas.

Otros:

1) La concentración de yodo en muestras de leche de los animales de cada hogar.
2) Concentración de yodo en las muestras de aguas del dominio público hidráulico de cada campamento.

¿Cómo lograr los objetivos:

1) Examinar la excreción de yodo en la orina de las madres y los niños vamos a necesitar una muestra de orina de cada uno.

2) La concentración de yodo en la leche materna queremos tener una muestra de leche materna de cada madre.

3) Examinar los niveles séricos de TSH, T4, tiroglobulina y anti-TPO, queremos una muestra de sangre de la madre y el niño.

4) Para analizar las concentraciones de yodo en la leche de los animales, queremos una muestra de la leche de los animales en cada hogar donde la madre o el niño ha estado tomando la leche de los animales.

5) Para analizar las concentraciones de yodo en el agua potable que queremos una muestra de agua de las aguas públicas de cada campamento

6) Antecedentes variables de las madres se recogerán a través de un cuestionario 1 llamado "cuestiones de fondo".

7) La ingesta de yodo de los niños y las variables de fondo para que los niños se recogerán a través de un cuestionario 2 llamadas "prácticas de lactancia materna".

8) El consumo de yodo entre las madres serán recogidos en un cuestionario 3 llamado " la ingesta de yodo de las mujeres"

9) El último cuestionario 4 llamado "muestras y mediciones" se debe utilizar para marcar de cada una de las muestras recogidas, orina, sangre, etc otros cuestionarios Además de las medidas antropométricas se debe escribir en este cuestionario.

Tamaño de la muestra

El diseño del estudio será una cohorte, en el que habrá un seguimiento a los 2 y 5 años, si la situación de los refugiados no ha cambiado. El estudio realizado ahora será el basline de la cohorte.

Las mujeres lactantes con niños 1 a 6 meses de edad serán seleccionados de los cuatro campamentos. Con ello se pretende hacer a través de los centros de salud en los campamentos. Hay aproximadamente 5-6 puestos de salud en cada campamento, en la que esperamos las listas de las mujeres con niños menores de 6 meses serán proporcionados. A

través de las listas, las mujeres y sus hijos serán seleccionados al azar. Quiremos hicimos un muestreo aleatorio.
Hemos calculado que el tamaño de la muestra debe consistir en 100 mujeres y 100 niños. Para dar cuenta de la deserción escolar en el seguimiento de los estudios, el 10% se han añadido a la muestra calculada, el tamaño total de la muestra por lo tanto será de 110 mujeres y niños 110.

El trabajo de campo

Los datos serán recogidos por 2 equipos, un equipo con Navnit en colaboración con un nutricionista, y otro equipo con Inger y un nutricionista. Los dos equipos se van de casa a casa y recoger todos los datos, a excepción de las muestras de sangre. Esperamos ser capaces de recoger los datos de tres días hogares pr pr equipo, un total de 6 días pr hogares. Vamos a tratar de terminar en un campo antes de pasar a la siguiente. Las muestras de sangre serán tomadas de todos los participantes en un campamento cuando todos los de la recogida de otros datos se termina allí. Así que cuando hayamos terminado en un campo de uno o dos días se utiliza para conducir a las mujeres con sus hijos al hospital para tomar muestras de sangre de ellos.

Cada tarde uno de los equipos tendrán que conducir alrededor de los participantes que han sido seleccionados para participar al día siguiente. Sólo queremos que las mujeres que están lactando a sus hijos, así que hay que preguntarles si lo hacen. Si son lactantes, se les informará del estudio y se les preguntó si quieren participar. Usted tiene que dar a las mujeres la carta de consentimiento para que lo puedan leer. Si no puede leer hay que leer para ellos. Si la mujer está seguro de que ellos y sus hijos quieren participar tienen que firmar la carta. Si no están en condiciones de firmar otra persona en el hogar o un amigo puede hacer por ellos.
Para las mujeres lactantes que deseen participar entregamos una bolsa de orina para el niño va a utilizar para recoger muestras de orina, y dos vasos. Vamos a pedirles que se han preparado una muestra de orina, tanto de la mujer y el niño cuando regresamos al día siguiente. También se entregará un extractor de leche que la mujer puede recoger la leche materna antes de que volviera al día siguiente. También entregamos un tubo que se debe verter la leche encima a después del bombeo. El tubo tiene un tapón de rosca, y es muy importante que la mujer da el tapón de rosca en el tubo después de verter sobre la leche. Si ella no desea utilizar la bomba,

se puede desconectar el recipiente de la bomba manual y dar una muestra en el recipiente, o directamente en el tubo.

Recopilación de datos

Muestras de orina

1) Los trabajadores de campo irá a la casa de las madres participantes en la noche, un día antes de la encuesta, para repartir una taza de orina para la madre de usar, y una bolsa de orina y una taza de orina para las madres a utilizar a sus hijos para recoger muestras de orina de ellos.

2) Las madres deben dar una muestra de orina de sí mismos en el vaso de orina. Además se debe recibir instrucciones de los trabajadores de campo sobre el uso de las bolsas de orina en sus hijos, por lo que pueden entregar una muestra de orina de los niños también. Las bolsas de orina no debe estar contaminada con heces.

3) Después de aplicar las bolsas de orina en los niños, la madre debe verter la orina recolectada en las bolsas de orina a lo largo de las tazas de orina, lo que la madre ha recibido.

4) Por lo menos 10 ml de orina, se requiere de las madres y los niños.

5) Las tazas de orina será recogida por los agentes de campo del día de la encuesta, cuando la altura y el peso se medirá y se pidió a los cuestionarios.

6) Las muestras de orina se transferirá a los tubos por los trabajadores de campo, y se sella herméticamente y se almacena en temperaturas de enfriamiento hasta su análisis.

Muestra de leche materna

La madre nos librará de la leche materna ya ha bombeado, en los tubos. Si ella no ha dado nada de leche, sin embargo, que quiere que le dan mientras estamos allí para recoger los datos.

Las muestras de sangre

1) Las madres y los niños a su debido tiempo serán transportados a los hospitales en cada campo para dar muestras de sangre. Las muestras de sangre serán transportados a Rabouni.

2) Un profesional de la salud serán responsables de la toma de muestras de sangre de las madres y uno será responsable de tomar muestras de sangre de los niños. Los profesionales de la salud debe estar capacitado para tomar muestras de sangre.

3) equipos estériles deben ser utilizados y el profesional de la salud deberán usar siempre guantes antes de tomar la muestra de sangre.

4) 4 ml de sangre (que da 2 ml de suero) se deben recoger de cada participante.

5) Cuando una muestra de sangre se toma se debe dar vuelta 80-10 veces antes de que se deja reposar durante 30 minutos.

6) Si la sangre recogida en el tubo es sólo la mitad, es importante abrir el tubo durante unos segundos antes de que se convirtió 8-10 veces y luego se deja reposar.

7) La muestra de sangre preferentemente deben ser centrifugadas antes de 2 horas. Sin embargo, puede ser centrifugadas dentro de 5 horas, pero hay que decir en la muestra cuánto tiempo se deja reposar antes de que se centrifuga, ya que puede afectar a los resultados.

8) La centrífuga debe tener la fuerza entre 1100 y 2000, preferiblemente en 1500. Es importante tener una cantidad equilibrada de los tubos en la centrífuga. Las muestras de sangre se centrifuga durante 10 minutos.

9) Cuando las muestras de sangre se centrifuga, el suero será en la parte superior del tubo. Mediante el uso de una pipeta, el suero debe ser transferido a un tubo nuevo. Recuerde que debe utilizar una pipeta nueva para cada muestra de sangre.

10) Después de transferir el suero, el tubo debe ser sellados y etiquetados correctamente de acuerdo con los números de identificación de los participantes.

11) El suero debe conservarse a -20 ° C hasta transportados a Noruega.

12) El suero debe ser transportado en bolsas de refrigeración de regreso a Noruega.

Muestra de leche animales

Tomamos muestras de los animales de leche de los hogares donde las mujeres o los niños han estado bebiendo la leche de los animales. Queremos que las muestras de la misma leche de la madre han sido dirking o el niño ha estado bebiendo. Si ha estado tomando varios tipos de leche en los últimos 7 días, queremos una muestra de cada uno de los tipos de leche. Si sólo ha estado tomando un tipo de leche en los últimos 7 días, sólo queremos una muestra de que la leche.

Muestra de agua

Queremos que cinco muestras de agua del agua pública de cada campamento. Si los informes de las mujeres que han recibido el agua de un pozo privado, queremos tomar una muestra del bien también.

Los cuestionarios 1,2,3 y 4

1) Los trabajadores de campo se van a las casas de los participantes para completar los cuestionarios. La madre, que es el participante en el estudio, se le pedirá que responda a las preguntas formuladas por el trabajador de campo.

2) El trabajador de campo comenzará con el cuestionario de antecedentes para reunir información básica del participante en el orden correcto de las preguntas.

3) Después de que el cuestionario de antecedentes, el trabajador de campo debe continuar con la encuesta de alimentación para el consumo de yodo. Es importante que el trabajador de campo, explica el cuestionario a los participantes. Recordatorio de 24 horas incluye el consumo desde el momento en que el participante se despertó ayer y hasta el momento en que

el participante se despertó hoy en día. 7 días retirada incluye los últimos 7 días y noches.

4) La encuesta de alimentación comienza con la ingesta de leche (de cabra, camello, cadida, leche en polvo y otros). El participante debe decir si borracho cualquiera de estos tipos de leche y el trabajador de campo debe continuar con las preguntas de seguimiento para los tipos de leche de acuerdo a los tipos que se ha bebido por el participante. Si la leche no se ha consumido, el trabajador de campo debe saltar por encima y continuar con la cuestión del agua y así sucesivamente.

5) El participante debe mostrarse lo mucho que bebía y comía de las diversas bebidas y alimentos. El participante podrá utilizar las tazas y las mediciones de su propia casa, que hace que sea fácil para que se acuerde la cantidad. El importe será transferido a una escala y se miden en gramos.

6) El cuestionario lactancia materna es el último de los cuestionarios. El trabajador de campo de preguntar a la madre de su bebé y cómo se alimenta. El cuestionario contiene preguntas sobre las prácticas de lactancia materna, y la ingesta de alimentos y bebidas del bebé en las últimas 24 horas y 7 días. En este cuestionario, ninguna cantidad será medido, sólo cómo muchas veces la comida o la bebida se le dio. Es importante tener paciencia y dejar que la madre trata de recordar de nuevo lo bastante precisos como sea posible.

Las mediciones antropométricas

1) Altura y peso se medirá a partir tanto de la madre y su hijo.

2) Una escala de altura a la neares mm se utiliza para medir la madre y el niño. La madre debe estar de frente a una pared con los talones, los hombros y la cabeza toutching la pared, mientras mira hacia adelante. El niño debe ser medida acostado en un banco estirada hacia fuera.

3) La madre se le pedirá que standt en una escala de peso digital para medir su peso al gramo más cercano. Ella debe tomar de sus zapatos y ropa tan poco ropa pesada posible. Si ella está usando un montón de ropa, debe ser por escrito, por lo que el peso de la ropa puede ser

quitado del peso total. El peso de la madre debe tener en cuenta befor darle al niño en la escala de peso, por lo que el peso del niño puede ser conocido por el aumento en la escala de peso.

Attachment 13-16

97 = Preguntas olvidadas
98 = No responde
99 = No sabe

El estudio del yodo en los campamentos Saharauis noviembre y diciembre 2010

Antecedentes de las madres

1. **Fecha** ....☐☐.☐☐.☐☐
2. **Identidad de la madre**.. ....☐☐☐-☐
3. **Identidad del niño** ....☐☐☐-☐
4. **Wilaya** .... ☐☐
   1=27. Febrero, 2=Smara, 3=Auserd, 4=Dajla, 5=Aaiun
5. **Daira** (escribir)____☐☐
   (Mirar la lista)
6. **Barrio (**escribir**)**____ ☐☐
   (Mirar la lista)

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7. **El nombre del nutricionista**____
8. **El tiempo de la encuesta** .... a) inicio ☐☐-☐☐ ...... b) final ☐☐-☐☐

Preguntas para la madre

9. Cuántos años tienes? .... ☐☐ años
10. Estado civil... .... ☐☐
    0=No casada, 1=Casada, 2=Divorciada, 3=Viuda
11. Has estado viviendo en otra wilaya?........................ .... ☐☐
    0=No, 1=Si

Si dice si

11.1.a) En que wilaya___________________________**11.1.b)** Periodo____________

11.2.a) En que wilaya___________________________**11.2.b)** Periodo____________

11.3.a) En que wilaya___________________________**11.3.b)** Periodo____________

12. Has estado fuera de los campamentos?...................... .... ☐☐
0=No, 1=Si

Si dice si

12.1.a) En donde_______________________________**12.1.b)** Periodo__________________

12.2.a) En donde_______________________________**12.2.b)** Periodo__________________

12.3.a) En donde_______________________________**12.3.b)** Periodo__________________

13. Nivel de estudio .... ☐☐
0=Nada, 1=Menos de 6 grado , 2=6 grado, 3=7grado -9 grado, 4=10 y 12 echo grado, 5=Universitario

14. Has hecho algún curso en los campamentos ....☐☐
0=No, 1=Si

Si dice si

14.1.a) En que curso___________________________**14.1.b)** Cuanto tiempo _____________

14.2.a) En que curso___________________________**14.2.b)** Cuanto tiempo______________

15. Cuantas lenguas hablas, lees o escribes? (marca con una X)

15.1.a) Hasanía .... **15.1.b)** hablar ☐

15.2.a) Arabic................. **15.2.b)** hablar ☐.......**15.2.c)** leer ☐... **15.2.d)** escribir☐

15.3.a) Español .... **15.3.b)** hablar ☐.......**15.3.c)** leer ☐.. **15.3.d)** escribir ☐

15.4.a) Otras lenguas (cual)**15.4.b)** hablar ☐ ....**15.4.c)** leer ☐.. **15.4.d)** escribir ☐

16. Trabajas fuera de casa en este momento? .... ☐☐
0=No, 1=Si

16.1 Si dice si, en qué?____

17. Cuantas personas viven en casa? (contar los estudiantes 12 de octubre y 9 de junio)☐☐

18. Quien es el responsable en la familia....................... .... ☐☐
0=Hombre, 1=Mujer

19. Edad del responsable de la familia .... ☐☐ años

20. Cuantos hijos tienes?

20.1.a) vivos..☐☐ **20.1.b)** muertos.......... ☐☐

21. Cuantos niños tienes que tengan menos de 5 años?..... .... ☐☐

El estudio del yodo en los campamentos saharauis noviembre y diciembre 2010

Como alimentar a el bebe

1. **Fecha**.. ....☐☐.☐☐.☐☐
2. **Identidad de la madre** ....☐☐☐-☐
3. **Identidad del niño**... ....☐☐☐-☐
4. **Wilaya** .... ☐☐
   1=27.Febrero, 2= Smara, 3= Ausserd, 4=Dakla, 5=El aiun
5. **Daira** (escribir*)*____ ..... ☐☐
   (Mirar la lista)
6. **Barrio** (escribir)____
   (Mirrar la lista)

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7. **El nombre del nutricionista** ____
8. **El tiempo de le encuesta**:......................... *a) inicio* ☐☐-☐☐....... *b) final* ☐☐-☐☐

Preguntas para la Madre

9. Sexo del bebe?... .... ☐☐
0=Masculino, 1=Femenino

10. Cuántos meses tiene el bebe? .... ☐☐ meses

11. Cuando nació el bebe?... ....☐☐.☐☐.☐☐ feche

12. Donde nació el bebe? .... ☐☐
1= En casa, 2=La dispensario, 3= Hospital de la wilaya, 4= Hospital de Rabounio, 5=Tindouf

13. Cuál era el peso del bebe cuando nació?...................... ....☐☐☐☐ gramos
13.1. Es el peso de oralmente o es escrito en el carne de salud?.................................. ☐☐
0= Oralmente, 1= Carne de salud

14. Cuanta era la medida del bebe cuando nació?............... .... ☐☐ cm
14.1. Es la medida oralmente o está escrita en carne de salud? .... ☐☐
0=Oralmente, 1= Carne de salud

15. Tuvo el bebe diarrea durante las dos últimas semanas?. .... ☐☐
0= No, 1= Si

16. Tuvo tu bebe algunas otras enfermedades durante los dos últimas semanas? .... ☐☐
0=No, 1=Si
Si dice si: Cual? (escribe)____

17. Has dado alguna medicinas a tu hijo en las últimas dos semanas? .... ☐☐
0=No, 1=si

Si dice si: Que tipo de medicina*?*

17.1. Natural medicina.. .... ☐☐
0=No, 1=si
Si dice si: Que tipo de medicina (escribir)____________________________________
17.2. Medicina del hospital... .... ☐☐
0=No, 1=Si
Si dice si: Que tipo de medicina (escribir)____________________________________

18. Cuanto tiempo después nacimiento del bebe, empezastes a darle el pecho? .... ☐☐
1=Entre durante la primera hora, 2=Entre las primeras 6 horas, 3=Después de las 6 horas (el primero día), 4=Segundo día, 5=Tercer día, 6=otro (Cuanto tiempo)______________________________

19. Has dado a tu hijo otra bebida antes de empezar a darle el pecho por primera vez? ... ☐☐
0=No, 1=Si

Si dice sí: Que has dado?

19.1. Agua con azúcar?.. .... ☐☐
0=No, 1=Si
Si dice si:
19.1.1 Qué tipo de agua? .... ☐☐
1=Agua publica, 2=Agua de botella, 3=Propia agua
19.1.2 Has hervido el agua antes de darle? .... ☐☐
0=No, 1= Si

19.2. Agua con aceite?... .... ☐☐
0=No, 1=Si
Si dice si:
19.2.1 Qué tipo de agua? .... ☐☐
1=Agua publica, 2=Agua de botella, 3=Propia agua
19.2.2 Has hervido el agua antes de darle? .... ☐☐
0= No, 1= Si

19.3. Leche o leche mezclada con agua?........................ .... ☐☐
0=No, 1=Si
Si dice si:
19.3.1 Que tipo de leche utilizas?.......................... .... ☐☐
1=Leche de cabra, 2= Leche de camello, 3=Leche de Candía, 4= Leche preparada
19.3.2 Hierves la leche o la mezclas antes de darle? .... ☐☐
0= No, 1= Si

19.4. Otro bebida, que? (escribir)____

20. Cuando das el pecho habitualmente al bebe? .... ☐☐
1=Cuando el bebe quiere, 2=A tiempos programados , 3=Ambos

21. Cuantas veces durante el DIÁ de ayer has dado el pecho a tu bebe?........................... ☐☐
0= nada, 1=1-5 veces, 2= 6-10 veces, 3=11-15 veces, 4=todo el tiempo

21.1. Era este un día normal? ... . ☐☐
0=No, 1=Si

Si dice no:

21.1.1. Porque no? (escribir)____

21.1.2. Cuantos veces das el pecho a tu bebe en un normal día?................................. ☐☐
0= nada, 1=1-5 veces, 2= 6-10 veces, 3=11-15 veces, 4=todo el tiempo

22. Cuantas veces durante la NOCHE hasta hoy has dado el pecho a tu bebe?................. ☐☐
0= nada, 1=1-5 veces, 2= 6-10 veces, 3=11-15 veces, 4=16-20 veces, 5=todo el tiempo

22.1. Era este un normal noche?.................................... .... ☐☐
0=No, 1=Si

Si dice no:

22.1.1 Porque no? (escribir)____

22.1.2. Cuantas veces das el pecho a tu bebe en una nórmala noche?.................... ☐☐
0= nada, 1=1-5 veces, 2= 6-10 veces, 3=11-15 veces, 4=16-20 veces, 5=todo el tiempo

Di esto a la madre: Se lanzaran una serie de cuestiones sobre la comida y la bebida la que a lo mejor has dado a tu bebe. Primero preguntamos sobre cuántos tiempos ayer has dado la comida o la bebida. Ayer quiere decir las 24 horas desde cuando tu bebe despertó por la mañana hasta cuando despertó hoy. Después preguntamos sobre cuántos tiempos en la última semana, 7 días y noches, que has dado (la comida o bebida). Si no has dado otra comida o bebida además del pecho en la última semana, puedes responder con ningún tiempo. Por favor intenta recordar y hacer lo posible.

Para los nutricionistas: Tenemos que preguntar a la madre sobre cuántas veces alimentado a su bebe, en las 24 horas y escribir eso. Y preguntarle por las veces que alimento a su bebe durante la semana, y escribirlo también. 24 horas son separadas de la semana.

23. Cuantas veces has dado a tu bebe algunas de estas seguidas comidas y bebidas:

Agua con azúcar

23.1. Cuantas veces de ayer? (día y noche).................... .... ☐☐ veces

23.2..Cuantas veces en la última semana? (7 días y noches en total)............................ ☐☐ veces

Si dice si ha dado:

23.2.1. El última vez que distes el agua, que tipo de agua utilizaste?.................... ☐☐ agua

1=Agua publica, 2=Agua de botella, 3=Propia agua

23.2.2 En la última vez que distes el agua, si la has hervido antes de darla? .... ☐☐

0= No, 1= Si

Agua con aceite

23.3. Cuantas veces de ayer? (día y noche).................... .... ☐☐ veces

23.4. Cuantas veces en la última semana? (7 días y noches en total)............................ ☐☐ veces

Si dice si ha dado:

23.4.1 La última vez que distes el agua, que tipo de agua utilizaste? .... ☐☐ agua

1=Agua publica, 2=Agua de botella, 3=Propia agua

23.4.2. En la última vez que distes el agua, si la has hervido antes de darla?........ ☐☐

0= No, 1= Si

Leche preparada

23.5. Cuantas veces de ayer? (día y noche).................... .... ☐☐ veces

23.6. Cuantas veces en la última semana? (7 días y noches en total)............................ ☐☐ veces

Si dice si ha dado:

23.6.1. La última vez que distes el leche preparada, que tipo de agua utilizaste?.. ☐☐ agua

1=Agua publica, 2=Agua de botella, 3=Propia agua

23.6.2. En la última vez que distes la leche preparada, si la has hervido antes de darla?
.... ☐☐

0= No, 1= Si

Leche de cabra o leche de cabra mezclada con agua

23.7. Cuantas veces de ayer? (día y noche).................... .... ☐☐ veces

23.8. Cuantas veces en la semana pasada? (7 días y noches en total)............................. ☐☐ veces

Si dice si ha dado:

23.8.1. La última vez que distes leche de cabra o la mezclada, si la has hervido antes de darla?... .... ☐☐

0= No, 1= Si

Leche de camello o leche de camello mezclada con agua

23.9....... Cuantas veces de ayer? (día y noche)............... .... ☐☐ veces

23.10. .. Cuantas veces en la semana pasada? (7 días y noches en total)....................... ☐☐ veces

Si dice si ha dado:

23.10.1. La última vez que distes leche de camello o la mezclada, si la has hervido antes de darla? .... ☐☐

0= No, 1= Si

Leche de Candía, o leche de Candía mezclada con agua

23.11. .. Cuantas veces de ayer? (día y noche)............... .... ☐☐ veces

23.12. .. Cuantas veces en la semana pasada? (7 días y noches en total)....................... ☐☐ veces

Si dice si ha dado:

23.12.1. La última vez que distes leche de Candía o la mezclada, si la has hervido antes de darla? .... ☐☐

0= No, 1= Si

Dátiles

23.13. .. Cuantas veces de ayer? (día y noche)............... .... ☐☐ veces

23.14. .. Cuantas veces en la semana pasada? (7 días y noches en total)....................... ☐☐ veces

Sopa

23.15. .. Cuantas veces de ayer? (día y noche)............... .... ☐☐ veces

23.16. .. Cuantas veces en la semana pasada? (7 días y noches en total)....................... ☐☐ veces

Avena

23.17. .. Cuantas veces de ayer? (día y noche)............... .... ☐☐ veces

23.18. .. Cuantas veces en la semana pasada? (7 días y noches en total)....................... ☐☐ veces

Pan

23.19. .. Cuantas veces de ayer? (día y noche)............... .... ☐☐ veces

23.20. .. Cuantas veces en la semana pasada? (7 días y noches en total)....................... ☐☐ veces

Huevo

23.21. .. Cuantas veces de ayer? (día y noche)............... .... ☐☐ veces

23.22. .. Cuantas veces en la semana pasada? (7 días y noches en total)....................... ☐☐ veces

Vegetables *(por ejemplo: zanahoria, patatas, cebolla, tomates, etc.)*
23.23. .. Cuantas veces ayer? (día y noche)................... .... ☐☐ veces
23.24. .. Cuantas veces en la semana pasada? (7 días y noches en total)...................... ☐☐ veces
Si dice si: que tipo?
(escribir)____

Frutas *(por ejemplo: plátanos, naranja, manzana, pera, etc.)*
23.25. .. Cuantas veces de ayer? (día y noche)............... .... ☐☐ veces
23.26. .. Cuantas veces en la semana pasada? (7 días y noches en total)...................... ☐☐ veces
Si dice si: que tipo? (escribir)____

Zumo
23.27. .. Cuantas veces de ayer? (día y noche)............... .... ☐☐ veces
23.28. .. Cuantas veces en la semana pasada? (7 días y noches en total)...................... ☐☐ veces

Dulces *(madalenas, galletas, etc.)*
23.29. .. Cuantas veces de ayer? (día y noche)............... .... ☐☐ veces
23.30. .. Cuantas veces en la semana pasada? (7 días y noches en total)...................... ☐☐ veces

Lentejas
23.31. .. Cuantas veces de ayer? (día y noche)............... .... ☐☐ veces
23.32. .. Cuantas veces en la semana pasada? (7 días y noches en total)...................... ☐☐ veces

Arroz
23.33. .. Cuantas veces de ayer? (día y noche)............... .... ☐☐ veces
23.34. .. Cuantas veces en la semana pasada? (7 días y noches en total)...................... ☐☐ veces

Otra, que (escribir)____
23.35. .. Cuantas veces ayer? (día y noche)................... .... ☐☐ veces
23.36. .. Cuantas veces en la última semana? (7días y noches en total)........................ ☐☐ veces

24. Cuántos meses tenia tu bebe cando empezastes a enseñarle a masticar o tragar comida, como pan, arroz fruta, avena, etc.?.............................. .... ☐☐ meses

25. Cuantos años tendrá tu bebe cuando decida parar de darle el pecho?.......................... ☐☐ meses

26. Comías más o menos o como siempre cuando estabas embarazada de este bebe?...... ☐☐
1=Comía mas, 2= Comía menos, 3= Como siempre

27. Has visitado algunos centros de salud cuando estabas embarazada con este bebe? ..... ☐☐
0=No, 1=Si
27.1. Si dice si: Cuantas veces .... ☐☐ veces

97 = Preguntas olvidadas
98 = No responde
99 = No sabe

El estudio del yodo en los campamentos Saharauis Noviembre y Diciembre 2010

Hábitos alimenticios por las madres

1. **Fecha** ....☐☐.☐☐.☐☐
2. **Identidad de la madre**.. ....☐☐☐-☐
3. **Identidad del niño** ....☐☐☐-☐
4. **Wilaya** .... ☐☐
   1=27.Febrero, 2= Smara, 3= Auserd 4=Dajla, 5=Aaiun
5. **Daira** (escribir)____☐☐
   (Mirar la lista)
6. **Barrio** (escribir)____☐☐
   (Mirar la lista)

---

7. **El nombre del nutricionista**____
8. **El tiempo de la encuesta**: .... a) inicio ☐☐-☐☐ .... b) final ☐☐-☐☐

Información para madres (leer): en este cuestionario, vamos a preguntar sobre el consume de leche, agua, te, sopa durante la semana pasada, y preguntar sobre la comida y bebida que consumiste durante las 24 horas, desde cuando despertases ayer hasta cuando despertases hoy. Vamos a comenzar con la leche y continuar con las demás comidas y bebidas.

97 = Preguntas olvidadas
98 = No responde
99 = No sabe

LECHE

9. Has bebido uno de estos tipos de leche durante la semana pasada?

(Decir todo tipo de leche)

9.1 Leche de cabra.. .... ☐☐

0=No, 1=Si

9.2 Leche de camello.. .... ☐☐

0=No, 1=Si

9.3 Candía (leche) .... ☐☐

0=No, 1=Si

9.4 Leche en polvo .... ☐☐

0=No, 1=Si

9.5 Otro tipo de leche .... ☐☐

0=No, 1=Si

Si NO: han bebido ninguna de estos tipos de leche vamos enseguida a la pregunta 30.

Si dice SI: continuamos con las preguntas depende del tipo de leche que han consumido.

97 = Preguntas olvidadas
98 = No responde
99 = No sabe

Leche de cabra

10. Como se hizo la mezcla de leche y agua?...................□□□□gramos leche □□□□ gramos agua

11. Qué cantidad de leche de cabra mezclada con agua has bebido en cada día de la semana pasada?

a) Ayer (Día 1) .... □□□□ gramos

b) Antes de ayer (Día 2)... .... □□□□ gramos

c) Día 3 .... □□□□ gramos

d) Día 4.. .... □□□□ gramos

e) Día 5 .... □□□□ gramos

f) Día 6 .... □□□□ gramos

g) Dia7 .... □□□□ gramos

12. De donde consigues la leche de cabra? .... □□

*1=De mi propia casa, 2=La compro (**Nota:** Utilizar el primer día que viene en la lista)*

Si lo copras:

12.1 De donde lo compras? (escribir)____

13. Si es esta cantidad habitual para ti en la semana?........ .... □□

0=No, 1=Si

Si dice NO

13.1 Porque no?
(escribir)____

Leche de camello

14. Como se hizo la mezcla de leche y agua?..................☐☐☐☐gramos leche ☐☐☐☐ gramos agua

15. Qué cantidad de leche de camello mezclada con agua has bebido en cada día de la semana pasada?

a) Ayer (Día 1) .... ☐☐☐☐ gramos

b) Antes de ayer (Día 2) .... ☐☐☐☐ gramos

c) Día 3 .... ☐☐☐☐ gramos

d) Día 4... .... ☐☐☐☐ gramos

e) Día 5 .... ☐☐☐☐ gramos

f) Día 6 .... ☐☐☐☐ gramos

g) Dia7 .... ☐☐☐☐ gramos

16. De donde consigues la leche de camello? .... ☐☐

*1=De mi propia casa, 2=La compro (**Nota:** Utilizar el primer día que viene en la lista)*

Si lo copras:

16.1. De donde lo compras? (escribir)____

17. Si es esta cantidad habitual para ti en la semana?....... .... ☐☐

0=No, 1=Si

Si dice NO

17.1 Porque no? (escribir)____

Candía (leche)

18. Como se hizo la mezcla de leche y agua?....................□□□□gramos leche □□□□ gramos agua

19. Qué cantidad de leche de Candía mezclada con agua has bebido en cada día de la semana pasada?

a) Ayer (Día 1) .... □□□□ gramos

b) Antes de ayer (Día 2)... .... □□□□ gramos

c) Día 3 .... □□□□ gramos

d) Día 4.. .... □□□□ gramos

e) Día 5 .... □□□□ gramos

f) Día 6 .... □□□□ gramos

g) Dia7 .... □□□□ gramos

20. De donde consigues la leche de Candía? .... □□
*1=De mi propia casa, 2=La compro (**Nota:** Utilizar el primer día que viene en la lista)*

Si lo copras:

20.1. De donde lo compras? (escribir)____

21. Si es esta cantidad habitual para ti en la semana?........ .... □□
0=No, 1=Si

Si dice NO

21.1 Porque no? (escribir)____

Leche en polvo

22. Como se hizo la mezcla de leche y agua?...................☐☐☐☐gramos leche ☐☐☐☐ gramos agua

23. Qué cantidad de leche en polvo mezclada con agua has bebido en cada día de la semana pasado?

a) Ayer (Día 1) ....☐☐☐☐ gramos

b) Antes de ayer (Día 2).. ....☐☐☐☐ gramos

c) Día 3 ....☐☐☐☐ gramos

d) Día 4.. ....☐☐☐☐ gramos

e) Día 5 ....☐☐☐☐ gramos

f) Día 6 ....☐☐☐☐ gramos

g) Dia7 ....☐☐☐☐ gramos

24. De donde consigues la leche en polvo? ....☐☐

*1=de mi propia casa, 2=la compro (**Nota:** Utilizar el primer día que viene en la lista)*

Si lo copras:

24.1. De donde lo compras? (escribir)____

25. Si es esta cantidad habitual para ti en la semana?........ ....☐☐

0=No, 1=Si

Si dice NO

25.1 Porque no? (escribir)____

Otro tipo de leche

26. Como se hizo las mezcla de leche y agua? ....☐☐☐☐gramos leche ☐☐☐☐ gramos agua

27. Qué cantidad de otro tipo de leche mezclada con agua has bebido en cada día de la semana pasada?

a) Ayer (Día 1) .... ☐☐☐☐ gramos

b) Antes de ayer (Día 2) .... ☐☐☐☐ gramos

c) Día 3 .... ☐☐☐☐ gramos

d) Día 4... .... ☐☐☐☐ gramos

e) Día 5 .... ☐☐☐☐ gramos

f) Día 6 .... ☐☐☐☐ gramos

g) Dia7 .... ☐☐☐☐ gramos

28. De donde consigues el otro tipo de leche? .... ☐☐

*1=de mi propia casa, 2=la compro (**Nota:** Utilizar el primer día que viene en la lista)*

Si lo copras:

28.1. De donde lo compras? (escribir)____

29. Si es esta cantidad habitual para ti en la semana?........ .... ☐☐

0=No, 1=Si

Si dice NO

29.1 Porque no? (escribir)____

97 = Preguntas olvidadas
98 = No responde
99 = No sabe

AGUA

30. Has bebido agua durante la semana pasada? .... ☐☐

0=No, 1=Si

Si NO: han bebido agua vamos enseguida a la pregunta 34.

Si dice SI: continuamos con las preguntas debajo.

31. Qué cantidad de agua has bebido en cada día de la semana pasada?

a) Ayer (Día 1) .... ☐☐☐☐ gramos

b) Antes de ayer (Día 2) .... ☐☐☐☐ gramos

c) Día 3 .... ☐☐☐☐ gramos

d) Día 4... .... ☐☐☐☐ gramos

e) Día 5 .... ☐☐☐☐ gramos

f) Día 6 .... ☐☐☐☐ gramos

g) Dia7 .... ☐☐☐☐ gramos

32. Qué tipo de agua usas para beber agua? .... ☐☐

1= Publica agua, 2= Propio agua, 3= Agua dulce, 4= Agua de botella, 5= Otro agua

*(**Nota:** Utilizar el primer día que viene en la lista)*

33. Si es esta cantidad habitual para ti en la semana?........ .... ☐☐

0=No, 1=Si

Si dice NO

33.1 Porque no? (escribir)____

97 = Preguntas olvidadas
98 = No responde
99 = No sabe

TE

34. Has bebido te durante los últimos 7 días?................... .... ☐☐

0=No, 1=Si

Si NO: han bebido te vamos enseguida a la pregunta 38.

Si dice SI: continuamos con las preguntas debajo.

35. Qué cantidad de te has bebido en cada día de los 7 días de la semana pasado?

a) Ayer (Día 1) .... ☐☐☐☐ gramos

b) Antes de ayer (Día 2) .... ☐☐☐☐ gramos

c) Día 3 .... ☐☐☐☐ gramos

d) Día 4 .... ☐☐☐☐ gramos

e) Día 5 .... ☐☐☐☐ gramos

f) Día 6 .... ☐☐☐☐ gramos

g) Dia7 .... ☐☐☐☐ gramos

36. Qué tipo de agua usas para hacer te? .... ☐☐

1= Publica agua, 2= Propio agua, 3= Agua dulce, 4= Agua de botella, 5= Otro agua

*(**Nota:** Utilizar el primer día que viene en la lista)*

37. Si es esta cantidad habitual para ti en la semana?........ .... ☐☐

0=No, 1=Si

Si dice NO

37.1 Porque no? (escribir)____

SOPA

38. Has comido sopa durante los últimos 7 días? .... ☐☐

0=No, 1=Si

Si dice SI: continuamos con las preguntas debajo.

39. Qué cantidad de sopa has comido en cada día de la semana pasado?

a) Ayer (Día 1) .... ☐☐☐☐ gramos

b) Antes de ayer (Día 2) .... ☐☐☐☐ gramos

c) Día 3 .... ☐☐☐☐ gramos

d) Día 4... .... ☐☐☐☐ gramos

e) Día 5 .... ☐☐☐☐ gramos

f) Día 6 .... ☐☐☐☐ gramos

g) Dia7 .... ☐☐☐☐ gramos

40. Si es esta cantidad habitual para ti en la semana?........ .... ☐☐

0=No, 1=Si

Si dice NO

40.1 Porque no? (escribir)____

Gracias por tu tiempo, y por responder a nuestras preguntas ☺

El estudio del yodo en los campamentos Saharauis Noviembre y Diciembre 2010

Las muestras y las mediciones de las madres y los niños

1. **Fecha**.. ....☐☐.☐☐.☐☐
2. **Identidad de la madre** ....☐☐☐-☐
3. **Identidad del niño**... ....☐☐☐-☐
4. **Wilaya** ....☐☐
   1=27. Febrero, 2= Smara, 3= Auserd, 4=Dajla, 5= Aaiun
5. **Daira** (escribir)____☐☐
   (Mirar la lista)
6. **Barrio** (escribir)____☐☐
   (Mirar la lista)

Peso y altura

7. Qué es el peso de la madre?.................................... ....☐☐,☐ kg
   7.1 Qué es el peso de la ropa de la madre? ☐ ½ kg, ☐ 1 kg, ☐ 2 kg
8. Qué es la altura de la madre? ....☐☐☐,☐ cm

9. Qué es el peso del niño?... ....☐☐,☐ kg
10. Qué es la altura del niño?....................................... ....☐☐☐,☐ cm

Muestra de orina

11. Es la muestra de orina de la madre recogida?............ ....☐☐
    0=No, 1=Si
12. Es la muestra de orina del niño recogida? ....☐☐
    0=No, 1=Si

Muestra de sangre

13. Es la muestra de sangre de la madre recogida?........... ....☐☐
    0=No, 1=Si
14. Es la muestra de sangre del niño recogida? ....☐☐
    0=No, 1=Si

Muestra de leche materna

15. Es la muestra de leche materna de la madre recogida? .... ☐☐

0=No, 1=Si

Muestra de agua

16. Es la muestra del agua de casa recogida? .... ☐☐

0=No, 1=Si

Muestra de leche de animal

17. Es la muestra de leche de animal de la casa recogida? .... ☐☐

0=No, 1=Si

Si dice si,

18. Cuántas son las muestras de leche de animal recogidas de la casa?........................... ☐☐

18.1 Que es el origen de la leche 1?............................ .... ☐☐

1=La wilaya, 2=La zona liberado, 3=Otros

18.2 Que es el origen de la leche 2? .... ☐☐

1=La wilaya, 2=La zona liberado, 3=Otros

Cuestionarios

19. Es el cuestionario 1- Antecedente información, llena lo?.. ☐☐

0=No, 1=Si

20. Es el cuestionario 2- Habitaos alimenticos por las madres, llena lo? .... ☐☐

0=No, 1=Si

21. Es el cuestionario 3 – Como alimentar a el bebe, llena lo? .... ☐☐

0=No, 1=Si

Attachment 17-18

Ministerio de Salud Pública

República Árabe Saharaui Democrática

Una carta para aceptar y participar en el estudio de yodo entre los refugiados Saharaui.

Estamos haciendo una investigación sobre la enfermedad del bocio en los campamentos saharaui. Es una de las responsabilidades del Ministerio de salud Saharaui. Para examinar y estudiar esta enfermedad. Si acepta la persona que es la madre y su hijo tenemos unas preguntas:

- Una muestra de leche materna
- Una muestra de orina
- Una muestra de sangre
- Medir y pesar
- Preguntar sobre la manera de amamantar al bebe
- Antecedentes personales
- Preguntar sobre la cantidad de leche, agua y te, que consumes
- Preguntamos sobre el origen del agua y la leche que tu bebes
- Queremos una muestra de leche animal y otra del agua

Tú y tu familia podéis ser elegidos. Estamos buscando madres que tengan hijos de 1ª6meses para participar en este estudio. Tú puedes ser uno de ellos, tenemos una lista con datos personales de todas las personas que han participado. En caso de encontrar cual quier problema esa persona será tratada. Este estudio continuara durante años para seguir el bien estar de su hijo preguntamos si podemos estar en contacto con usted, este estudio durara 2años y después se darán los resultados

Tu colaboración ayudara en resolver este problema, este trabajo depende de ti y nadie te lo puede obligar.

Este estudio es una colaboración entre el ministerio de salud saharaui y la NCA,
y sea realizado gracias al doctor Abdarahman y la nutricionista Ingrid Barikmo

---***--------------***---

Yo y mi hijo aceptamos para participar en esta encuesta y debo de dar una muestra de orina otra de leche materna y una de sangre, también tengo que responder unas preguntas, y me puedo retirar en cualquier momento.

____ ______________

Firma Fecha

Akershus University College

NORWEGIAN CHURCH AID

Ministerio de
Salud Pública

República Árabe
Saharaui Democrática

رسالة للقبول و المشاركة في دراسة البوثيو لدى الصحراويين

نحن نقوم بهدا البحث لان المجثمع الصحراوي يعاني من هدا المرض و هده مهمة من مهام وزارة الصحة لفحص ودراسة هدا المشكل

ان وافقث و شاركث انث وولدك فعليك بالثالي:

- فحص للبول
- فحص للدم
- قياس الوزن و الطول
- كيفية اطعام الطفل
- اخد معلوماث حول الام و الطفل
- مصدر الماء و الحليب الدي ثثناوله الام

انث و عائلثك قد ثخثارون فنحن نبحث عن امهاث لاولاد ثثراوح اعمارهم ما بين 1الى6اشهر للمشاركة و سيكون اسمك في هده اللائحة الثي سثكون فيها اسئلثك ومعلوماثك مقدمة و في حالة اكثشاف اي شئ يحثاج للعلاج يلؤخد اسمك من طرف الدكثور
سنواصل البحث لسنواث قادمة لمثابعة وضع طفللك لدللك نسال ان كنا نسثطيع الاثصال بك ثانية لان مسايرة البحث الاول سثكون في عامين و لائحة المعنيين سثؤخد للعودة اليهم

وان شاركث سثساهم في حل هدا المشكل لدى الصحراويين و سثساعد وزارة الصحة في معرفة وضعك و وضع طفللك و هدا البرنامج يعثمد عليك بالدرجة الاولى فلا احد يسثطيع ارغامك ان لم ثرغب في المشاركة و ان شاركث فثاكد بانك لن ثندم

هدا البرنامج ثعاون ما بين وزارة الصحة الصحراوية و المنظمة النرويجية للمساعدة والاشخاص المعنيين هم الدكصور عبد الرحمن والنرويجية انقريد باريكمو

--***--------------***--

انا اقبل و طفلي بان نشارك في هدا البرنامج و انا اعلم باني ساجري فحص للدم+الحليب+البول و بساجيب على كامل الاسئلة

الثاريخ __________ الثوقيع ______________________________

NORWEGIAN CHURCH AID

Akershus
University College

Attachment 19

Calendario estudio de yodo 2010

Sabado 30.10	**Domigo 31.10**	**Lunes 01.11**	**Martes 02.11**	**Miércoles 03.11**	**Juvenes 04.11**	**Viernes 05.11**
27.Febrero Piloto Todos **Tarde** Alién, traductora, laboratoria, jefe de disp. estudiante (4 M)	27.Febrero **Dia** Ahmed/ estudiante Salamu/ estudiante **Tarde** Alién, traductora, laboratoria, jefe de disp. estudiante (4 M)	27.Febrero **Dia** Ahmed/ estudiante Salamu/ estudiante **Smara** **Tarde** Alién, traductora, laboratoria, jefe de disp. estudiante Ingrid (6 M)	Smara **Dia** **Tarde** Ahmed/ estudiante Salamu/ ingrid Alién, traductora, laboratoria, jefe de disp. estudiante (8 M)	Smara **Dia** Ahmed/ estudiante Salamu/ estudiante **Tarde** Ahmed/ ingrid Salamu/ estudiante Alién, traductora, laboratoria, jefe de disp. estudiante (8 M)	Smara **Dia** Ahmed/ estudiante Salamu/ Estudiante **¿Tarde** Ahmed/ estudiante Salamu/ estudiante	
Sabado 06.11	**Domingo 07.11**	**Lunes 08.11**	**Martes 09.11**	**Miércoles 10.11**	**Juvenes 11.11**	**Viernes 12.11**
Smara **Dia** **Tarde** Alién, traductora, laboratoria, jefe de disp. estudiante (9 M)	Smara **Día** Ahmed/ estudiante Salamu/ estudiante **Tarde** Ahmed/ estudiante Salamu/ estudiante	**Smara** **Dia** Auserd **Tarde** Alién, traductora, laboratoria, jefe de disp. estudiante (8 M)	Auserd **Dia** **Tarde** Ahmed/ estudiante Salamu/ estudiante Alién, traductora, laboratoria, jefe de disp. estudiante (8 M)	Auserd **Día** Ahmed/ estudiante Salamu/ estudiante **Tarde** Salamu/ Estudiante Alién, traductora, laboratoria, jefe de disp. estudiante (9 M)	**Auserd** **Día** Ahmed/ estudiante Salamu/ Estudiante **Tarde** Ahmed/ estudiante Salamu/ estudiante	

Sabado **13.11**	**Domingo** **14.11**	**Lunes** **15.11**	**Martes** **16.11**	**Miércoles** **17.11**	**Juvenes** **18.11**	**Viernes** **19.11**
Sabado **20.11** Dajla **Día** **Tarde** Alién, traductora, laboratoria, jefe de disp. estudiante (8 M)	**Domingo** **21.11** Dajla **Día** Ahmed/ estudiante Salamu/ estudiante **Tarde** Salamu/ Estudiante Alién, traductora, laboratoria, jefe de disp. estudiante (7 M)	**Lunes** **22.11** Dajla **Dia** Ahmed/ estudiante Salamu/ estudiante **Tarde** Ahmed/ estudiante Salamu/ estudiante	**Martes** **23.11**	**Miércoles** **24.11**	**Juvenes** **25.11**	**Viernes** **26.22**
Sabado **27.11** **Aaiun** **Día** **Tarde** Alién, traductora, laboratoria, jefe de disp. estudiante (8 M)	**Domingo** **28.11** **Aaiun** **Día** Ahmed/ estudiante Salamu/ estudiante **Tarde** Ahmed/ estudiante Alién, traductora, laboratoria, jefe de disp. estudiante (8 M)	**Lunes** **29.11** **Aaiun** **Día** Ahmed/ estudiante Salamu/ estudiante **Tarde** Ahmed/ estudiante Salamu/ estudiante	**Martes** **30.11** **Aaiun** **Día** **Tarde** Alién, traductora, laboratoria, jefe de disp. estudiante (8 M)	**Miércoles** **01.12** **Aaiun** **Día** Ahmed/ estudiante Salamu/ estudiante **Tarde** Salamu/ Estudiante Alién, traductora, laboratoria, jefe de disp. estudiante (7 M)	**Juvenes** **02.12** **Aaiun** **Día** Ahmed/ estudiante Salamu/ estudiante	**Viernes** **03.12**
Sabado **04.12**	**Domingo** **05.12**					

Attachment 20

EMBAJADA DE LA REPUBLICA
ARABE SAHRAUI DEMOCRATICA

ARGEL

سفارة الجمهورية العربية
الصحراوية الديمقراطية

الجزائر

L'Ambassade de la République Arabe sahraouie démocratique en Algérie présente ses compliments aux autorités algériennes compétentes et a l'honneur de solliciter leur intervention pour **faciliter le transit vers la Norvège -via Paris- des échantillons que transporte l'équipe norvégienne dont les noms de ses membres sont mentionnés ci-dessous. Et ce en vue de la réalisation des études dans les laboratoires norvégiens afin de déterminer les causes du goitre qui affecte un bon nombre des refugiés sahraouis, et ses conséquences sur leur santé.**
Cette opération entre dans le cadre de la collaboration du Ministère de la Santé Publique Sahraouie et, l'Aide de l'Eglise Norvégienne (NCA) et le Collège d'Akershus (Réalisation d'une étude approfondie sur le lait des chèvres et l'eau quelles consomment).

Les échantillons:

- Echantillons d'urine .... 230.
- Echantillons de sérum .... 115.
- Echantillons de lait .... 160.
- Echantillons de l'eau .... 30.

Les membres de l'équipe:

- Inger Aakre , passeport n° : 25177799.
- Grewal Kaur Navnit, passeport n°: 25093303.
- Barikmo Elisabet Igrid, passeport n°: 28083611.

Le trajet:

- Tindouf/Alger: 6/12/2010.
- Alger/Paris : 7/12/2010.

L'Ambassade de la République Arabe sahraouie démocratique en Algérie, saisit cette occasion pour vous renouveler les assurances de sa haute considération.

ابراهيم غالي

BRAHIM GHALI

1, rue Franklin Roosevelt - 16000 Alger - Algérie
Tél. : (213 21) 74 34 91 - Fax : (213 21) 74 05 90
(213 21) 74 77 44

1، شارع فرانكلين روزفلت - 16000 الجزائر
هاتف :91 34 74 (213 21) - فاكس :90 05 74 (213 21)
(213 21) 74 77 44