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High sugar consumption and poor nutrient intake among drug addicts in Oslo, Norway

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Abstract

Poor dietary habits among drug addicts represent health hazards. However, very few studies have focused on dietary intake as an independent health risk factor in relation to this group. The objective of the present study was to examine the dietary habits of drug addicts living on the fringes of an affluent society. The study focused on food access, food preferences, intake of energy and nutrients, and related nutrient blood concentrations. The respondent group consisted of 123 male and seventy-two female drug addicts, who participated in a cross-sectional study that included a 24 h dietary recall, blood samples, anthropometrical measurements and a semi-structured interview concerning food access and preferences. Daily energy intake varied from 0 to 37 MJ. Food received from charitable sources and friends/family had a higher nutrient density than food bought by the respondents. Added sugar accounted for 30 % of the energy intake, which was mirrored in biomarkers. Sugar and sugar-sweetened food items were preferred by 61 % of the respondents. Of the respondents, 32 % had a TAG concentration above the reference values, while 35 % had a cholesterol concentration beneath the reference values. An elevated serum Cu concentration indicated inflammation among the respondents. Further research on problems related to the diets of drug addicts should focus on dietary habits and aim to uncover connections that may reinforce inebriation and addiction.

Key words: Nutritional status: Drug addicts: Illegal drugs: Nutrient intake: Food intake: Diet

There is a general opinion that drug addicts' poor health is primarily caused by the use of illegal drugs. Inadequate food and nutrient intake have not attracted the same scientific attention, although dietary habits are generally accepted as important predictors of the health and nutritional status of a population[(1)].

It has previously been pointed out that addicts' lives are unstable, alternating between periods of hectic drug abuse and calmer rehabilitation[(2)]. Most studies dealing with food habits and nutritional status in relation to addiction have focused primarily on alcoholics[(3)]. Drug addicts have not received the same scientific attention, although nutritional status has been assessed, for example, during detoxification and rehabilitation. Such studies have revealed poor protein and vitamin status[(4–7)]. Malnutrition has also been described during autopsies of drug addicts[(8)]. However, these cases represent end-stage situations, and probably do not reflect the circumstances of the living population of drug addicts.

Drug addicts' acquired preference for sweet food items has attracted scientific attention, as have the neural similarities between the responses to eating and abusing drugs[(9,10)]. Searches of the ISI Web of Knowledge and the Cochrane and Medline databases produced few results relating to dietary intake and related health conditions among drug addicts who do not participate in any treatment or rehabilitation programme. The present investigation recruited participating addicts on the streets, at night shelters and at meeting places. An underlying assumption is that drug addicts' personal preferences and food choices are most genuinely expressed in their day-to-day actions.

The objectives of the present study were to investigate access to food, dietary intake during the previous 24 h, and to assess nutritional status among the drug addicts

Abbreviations: E%, energy percentage; HbA1c, glycosylated Hb; PALei, physical activity level; RI, recommended intake.

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by blood analyses of TAG, lipoproteins and selected nutrients in relation to reference values.

Materials and methods

Study design

The study was a cross-sectional comprehensive study that included interviews using a pre-coded questionnaire, one 24 h dietary recall, clinical examination, anthropometrical measurements and blood sampling. The interviews were carried out in the period from November 2001 to April 2003. After completion of the medical examination and interviews and collection of blood samples, the participants were offered a snack consisting of yoghurt, muffins and chocolate milk, as well as cigarettes.

The study was carried out in accordance with the Helsinki Declaration (WMA 2002), and was approved by the Norwegian Regional Committee for Medical Ethics. Permission to store personal data on files was obtained from the Norwegian Social Science Data Service. Each participant gave his/her written consent.

Subjects

Drug addicts were contacted at hospices, lodgings, night shelters, meeting places and directly on the streets in Oslo (the capital of Norway). Recruitment and examination took place at twenty-three different locations, both at night and in daytime. A total of 220 respondents were recruited. The interview, anthropometrical measurement, medical examination and blood sampling were carried out immediately after a participant agreed to participate. The number of participants was reduced to 195 adult respondents (123 males and seventy-two females) because of difficulties experienced in collecting blood samples due to damaged veins (caused by regular injections and long-term insufficient hygiene). These dropouts may have influenced the results, but all the participants were intoxicated and heavy users of illegal drugs. Of the participants, 16 % reported living outside Oslo. Women accounted for 37 % of the total sample. The addicts were not participating in any drug-related treatment programme at the time of this assessment.

The respondents were all above 18 years of age. The mean age of the 123 males was 36·2 (SD 7·0) years. For the seventy-two females, it was 34·5 (SD 7·4) years. Initial drug use had started at the mean ages of 14·4 (SD 4·2) years (males) and 16·1 (SD 6·6) years (females). The males had used injections for a mean period of 14·9 (SD 9·0) years, and the females for 14·1 (SD 8·8) years. All of the subjects reported smoking tobacco.

Methods

Four nutritionists conducted the interview using a pre-coded questionnaire to obtain information about living conditions and the preference for sweet food items. A dietary recall, where the respondents were asked what they had eaten during the previous 24 h, was carried out. The respondents were further asked if the food was obtained from private or public contributors, or bought independently. The timing of food intake (data not included in the results) and use of food supplements were also registered. Models of glasses, cups and plates of different sizes were used to quantify the portion sizes, in addition to pictures of the dishes most commonly served at places where drug addicts are offered food. Nutrient intake was calculated using the Norwegian Food Composition Table[11] and FoodCalc software[12]. Added sugar was calculated as sucrose present in jam, soft drinks, cakes, ice cream, and chocolate as well as sugar added to coffee and tea or sprinkled on cereals. To ensure homogeneity in the data collection, inter-correlation analyses were performed on the interviewers.

Validation

To test the validity of respondents' information, the blood samples were analysed with respect to illegal drugs in the first twenty-five respondents. Of the illegal drugs reported by the respondents, 98 % were detected in the blood analyses. This indicated that the respondents were able to give valid information.

Eighty-three percent of the men and 47 % of the women had a BMI (kg/m^2) within the normal BMI range ($18·5 < BMI \leq 25\,kg/m^2$), 10 % of the women and 3 % of the men had a BMI beneath the normal range and 22 % of the females and 14 % of the males had a BMI above the normal range[2]. Physical activity level (PALei) (energy intake/RMR) was calculated to estimate energy intake in relation to calculated energy requirement, and used to illustrate the range in energy intake among the respondents. RMR was calculated using the WHO expert group standard equation[13], using measured weight and height at the time of examination. Calculated PALei values were divided into four categories corresponding to; no food intake $PALei = 0$, bed rest $PALei \leq 1·2$, homoeostatic eating $1·2 < PALei < 2·2$ and a positive energy balance $PALei \geq 2·2$[14].

Laboratory analyses

One physician and three biomedical laboratory scientists collected blood from the drug addicts by venepuncture. TAG, total cholesterol and HDL-cholesterol were determined by enzymatic methods on a Modular P analyzer (Roche, Castle Hill, NSW, Australia).

LDL-cholesterol was calculated using the Friedewald equation. HbA1c was analysed by means of an immunoturbidimetric assay on a Hitachi 917 analyzer (Roche). Se, Zn and Cu in serum were measured by means of graphite furnace atomic absorption spectrometry, on a Solaar M6

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instrument from Thermo Elemental. These analyses were performed at Fürst Medical Laboratory (Oslo, Norway), and accredited/certified in accordance with NS-EN ISO/IEC 17 025.

C-peptide levels were determined on an Immulite 2000 (Diagnostic Products Corporation, Los Angeles, CA, USA) by Oslo University Hospital, Aker Hormone laboratory. Vitamins A, D and E were all analysed from serum samples in the same assay to avoid inter-assay variations. Analyses of fat-soluble vitamins were carried out by AS Vitas (Oslo, Norway; www.vitas.no), performed using an HP 1100 liquid chromatograph (Agilent Technologies, Palo Alta, CA, USA). Thiamine diphosphate (vitamin B_1)[15] in blood was determined by HPLC, and ascorbic acid (vitamin C) in serum with a photometric assay method was used for the assay[16] at Oslo University Hospital, Aker Nutritional Laboratory.

Statistics

Food group intake is presented as means and standard deviations including only those who had an intake of that food group at the day of investigation. Nutrient intake was evaluated by reference to the Nordic Nutrition Recommendation and the recommended intake (RI)[17]. Parametric tests were performed for normally distributed data, while non-parametric tests were used for non-normally distributed data. Student's *t* tests and Mann–Whitney *U* tests analysed the differences between groups. Correlation coefficients were analysed using Pearson's test and Spearman's tests. *P* values≤0·05 were considered significant. All the statistical analyses were performed using SPSS, version 14.00 (SPSS, Inc., Chicago, IL, USA).

Results

Limited access to food was reported by 64 % of the drug addicts, mainly due to a lack of money. In response to the question of how they obtained food, 68 % stated that they bought most of the food themselves, while 32 % named family/friends and public/private charitable organisations as the providers of most of the food. Eleven percent also admitted theft from grocery stores, and 4 % had collected food from garbage bins. A special preference for sweet food items was reported by 61 % of the respondents.

Most meals eaten during the previous 24 h consisted of sandwiches and snacks, which accounted for 60 % of energy intake. Males had dinner more frequently than females, while females had more snack meals.

Except for sugar-sweetened soft drinks and bread/cereals, no food group was consumed by more than 50 % of the respondents (Table 1). Less than 30 % of the respondents had consumed vegetables, fruit or fish during the previous 24 h. In general, there was little variation in the addicts' food choices, with a common preference for food items containing added sugar which were easy to chew.

Table 1. Number of respondents reporting intake of food items from the different food groups during the previous 24 h

(Mean values and standard deviations, *n* 184)

Food groups	*n*	%	Mean (g)	SD
Sugar-sweetened soft drinks	119	65	793	662
Bread/cereals	115	63	187	167
Milk	90	49	500	500
Meat and meat products	84	46	220	218
Butter/margarine	77	42	35	44
Ice cream and milk desserts	62	34	263	222
Cookies	56	30	153	107
Sweets	55	30	95	84
Coffee	48	26	430	329
Vegetables	43	23	133	124
Fruit	37	20	315	365
Sweet spreads	36	20	56	58
Cheese	35	19	46	37
Yoghurt	30	16	241	123
Fish and fish products	27	15	93	72
Potatoes	22	12	187	118
Juice	22	12	574	437
Eggs	15	8	104	64
Snacks	5	3	164	128
Artificially sweetened soft drinks	5	3	590	230

Five percent of the male addicts and 6 % of the females reported no food intake in the last 24 h corresponding to PALei = 0 (Fig. 1). Forty-seven percent of the males and 62 % of the females fell into the category PALei ≤ 1·2. The category 1·2 < PALei < 2·2 covered 38 % of the male addicts and 20 % of the females, while 10 % of the males and 12 % of the females fell into the category PALei ≥ 2·2. The respondents who reported limited access to food had a lower PALei than those who reported

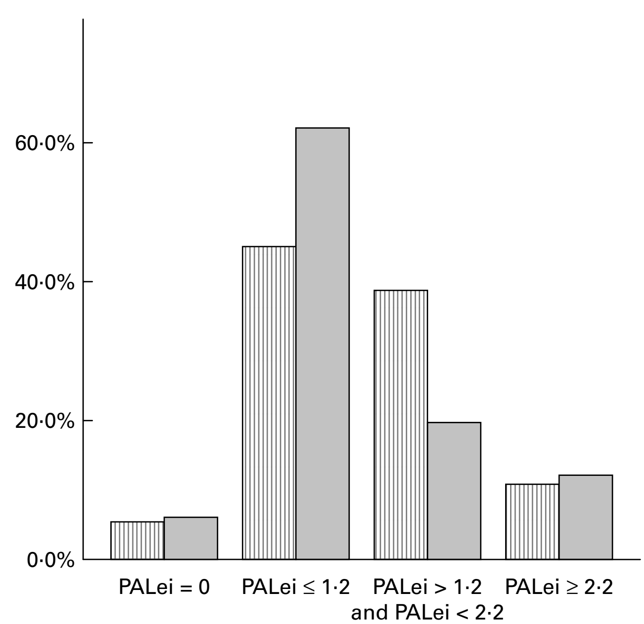

Fig. 1. Proportion of drug addicts by physical activity level (PALei) categories (n_{Male} 123, n_{Female} 72). EI, energy intake. PALei = 0 (corresponding to no food intake in the previous 24 h), PALei ≤ 1·2 (corresponding to bed rest), 1·2 < PALei < 2·2 (corresponding to homoeostatic eating) and PALe ≥ 2·2 (corresponding to consumption of more energy than expended during the previous 24 h). ▥, Male; ▦, female.

Table 2. Energy percentage distribution from macronutrients and alcohol among drug addicts during the previous 24 h

(Mean values and standard deviations, *n* 184 (men and women together))

	Energy percentage (%)	
Nutrients	Mean	SD
Protein	11	5
Fat	27	13
Saturated fat	12	7
Monounsaturated fat	8	4
Polyunsaturated fat	4	4
Carbohydrates	60	17
Added sugar	30	23
Alcohol	2	12

being satisfied ($P=0·050$ for women and $P=0·052$ for men). There was no correlation between BMI and PALei.

Mean for energy intake for the male drug addicts was 9·2 (SD 5·6) MJ, while the females' intake corresponded to 6·8 (SD 5·3) MJ among those who reported food intake in the last 24 h. Minimum and maximum energy intake on the day of investigation varied from 0 to 37·0 MJ for men and from 0 to 29·4 MJ for women. The energy percentage (E%) distribution between the macronutrients and alcohol is shown in Table 2. Protein contributed with 11 E% in total, with 3 E% from milk and milk desserts in both sexes. For the male addicts, meat and meat products contributed with 3 E%, and 1·3 E% for the females, while protein from cereals gave 2 and 1 E% for men and women, respectively. Protein from sweet cakes and sweet yeast rolls added 1 E% to the females' diet. No correlation was found between protein intake and serum albumin concentrations. Alcohol intake was 9·9 (SD 37·1) and 2·6 (SD 12·3) g for men and women, respectively, corresponding to 2 (SD 12) E% of the total energy intake (Table 2).

Fat accounted for 27 (SD 13) E% and polyunsaturated fat accounted for 4 (SD 7) E% for the whole sample. Total carbohydrates accounted for 60 (SD 17) E% and added sugar provided 30 (23) E% (Table 2) with a maximum amount of 850 g. The fibre content of the diet was 1·3 (SD 0·9) g/MJ.

The intakes of vitamins and minerals were below the RI, and only 20 % of the respondents reached the RI levels for thiamin, ascorbic acid, Mg and Fe; correspondingly 30 % for riboflavin, niacin, Ca, Zn and Cu. Hardly any respondent reached the RI for vitamin D (Table 3). Only three respondents reported intake of a dietary supplement during the previous 24 h (data not included in the results). Food from charitable sources and friends was more nutrient dense and had a higher concentration of vitamin D, Se, Fe, vitamin A, thiamin, niacin, ascorbic acid and Zn than food bought by the respondents ($P<0·05$). Drug addicts who reported limited access to food had lower intakes of thiamin, niacin and Mg ($P=0·051$) than those who were content with their food intake. In addition, the males who reported not having enough to eat also had lower intakes of the vitamins A, D and E, riboflavin, K and Se ($P=0·05$ for all).

There were no significant differences between the sexes in relation to blood parameter concentrations, apart from glycosylated Hb (HbA1c), vitamin A, Se and Cu (Table 4). The mean concentrations of TAG, HbA1c and C-peptides fell into the normal range. More than 20 % of the respondents had TAG concentrations above the upper reference values, with maximum values of 3·43 and 3·16 mmol/l for males and females, respectively. For the participants, 35 % had total cholesterol concentrations below reference

Table 3. Nutrient intake among drug addicts in Oslo and the percentage below the recommended dietary intake according to the Nordic Nutrition Recommendations (NNR)†

(Median values and 5th (P5)–95th percentiles (P95))

	Male (*n* 116)			Female (*n* 68)		
	Median	P5–P95	Percentage below NNR† (reference value)	Median	P5–P95	Percentage below NNR† (reference value)
Vitamin A (μg)	402*	0–1580	93 (900 μg)	218	0–1315	82 (700 μg)
Thiamin (mg)	0·8**	0–2·7	72 (1·4 mg)	0·5	0–2·5	83 (1·1 mg)
Riboflavin (mg)	1·2*	0–5·1	61 (1·7 mg)	0·8	0–6·1	64 (1·3 mg)
Niacin equivalents (mg)	17·6**	0–50·0	57 (19 mg)	8·4	0–44·8	71 (15 mg)
Ascorbic acid (mg)	12	0–229	77 (75 mg)	10	0–305	76 (75 mg)
Vitamin D (μg)	0·7	0–5·7	98 (7·5 μg)	0·4	0–4·8	100 (7·5 μg)
Vitamin E (mg)	4	0–14	83 (10 mg)	3	0–17	85 (8 mg)
Ca (mg)	500	0–1950	62 (800 mg)	445	0–1790	78 (800 mg)
Mg (mg)	230**	0–655	74 (350 mg)	150	0–570	79 (280 mg)
K (g)	2·3*	0–5·4	82 (3·5 g)	1·6	0–5·2	88 (3·1 g)
Se (μg)	20*	0–73	85 (50 μg)	10	0–75	90 (40 μg)
Fe (mg)	5·8**	0–22·0	74 (9 mg)	3·4	0–17·0	90 (15 mg)
Zn (mg)	6·5**	0–18·5	64 (9 mg)	3·4	0–20·9	75 (7 mg)
Cu (mg)	0·8**	0–2·7	55 (0·9 mg)	0·5	0–2·0	75 (0·9 mg)

Difference between sexes: *$P<0·05$ and **$P<0·01$.

† Equal to recommended dietary intake.

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Table 4. Lipids and selected nutrient concentrations in blood of drug addicts with reference values
(Mean values and standard deviations)

	Male				Female			
	n	Mean	SD	Reference values	*n*	Mean	SD	Reference values
TAG (mmol/l)	113	1·37	0·67	< 1·7	66	1·37	0·61	< 1·8
Total cholesterol (mmol/l)	113	4·85	0·90	3·6–7·0	66	4·14	0·88	3·9–8·0
HDL (mmol/l)	112	1·14	0·33	0·8–2·0	63	1·24	0·44	0·8–2·0
LDL (mmol/l)	106	2·29	0·81	1·6–5·7	58	2·23	0·70	1·6–5·7
HbA1c (%)	111	5·8	0·7	5·0–6·0	64	5·9	0·9	5·0–6·0
C-peptide (pmol/l)	95	1342	910	220–1400	56	1168	541	220–1400
25-Hydroxy-vitamin D_3 (nmol/l)	95	38·6	26·8	50–150	63	37·5	23·7	50–150
Retinol (μmol/l)	97	1·59	0·55	> 0·7	61	1·33	0·63	> 0·7
Tocopherol (μmol/l)	84	21·8	4·8	14–50	54	22·5	5·7	14–50
Se (μmol/l)	96	0·78*	0·16	0·6–1·8	53	0·72	0·16	0·6–1·8
Zn (μmol/l)	59	12·7	3·26	9·0–17·0	29	11·7	2·79	9·0–17·0
Cu (μmol/l)	81	22·63	3·84	12·0–25·0	49	24·81	3·98	12·0–25·0
Ascorbic acid (μmol/l)	30	56·6	30·2	45–92	10	58·4	32·2	45–92
Thiamin (nmol/l)	71	90·0	16·3	55–125	34	84·9	22·8	55–125

values; correspondingly, 12 % HDL and 17 % LDL concentrations were below the lower reference value; no concentration was above the upper reference value. The concentrations of HbA1c were above the reference value for 12 % of the males and 20 % of the females. For C-peptide concentrations, 32 % of the male and 34 % of the female respondents exceeded the upper reference value. The maximum concentrations of HbA1c were 11·7 and 12·0 % for males and females, respectively, and for C-peptide, the maximum concentrations were 5·275 and 2·475 pmol/l, respectively. Of the respondents, 70 % did not reach the lower reference value for 25-hydroxy-vitamin D_3. For vitamin A, none had a concentration beneath the reference value. The females had a sub-reference value of vitamin E concentration three times more often than the males. Se concentrations were within reference values for 91 % of the male and 84 % of the female addicts; none of the respondents had a concentration above the reference values. Zn concentrations were within reference values for 88 %, and 7 % were below. Concerning Cu, 35 % of the men and 32 % of the women had concentrations above reference values, and none had subnormal values.

The vitamin C blood concentrations of 50 % of the respondents fell below the reference value, while 10 % of the Se concentrations fell below the reference values. The males who reported limited access to food had lower blood concentrations of TAG ($P = 0·01$), vitamin A and total cholesterol (all $P < 0·05$), which was not the case for the females.

Discussion

More than half of the addicts reported limited access to food, explained by shortage of money. Energy intake varied considerably between the respondents, and the food choices in general seemed restricted. The respondents, particularly the female addicts, showed a preference for unhealthy food items such as sweet snacks and sweet beverages. The nutrient density was lower for self-selected food than that received from friends/family and public/private charitable sources. Moreover, the intakes of vitamins and minerals were below the RI. The corresponding blood parameters were below, or in the lower part of the reference value range, supporting the findings of low food intake and poor food choices.

The challenges faced in carrying out the present study, and the ability of the respondents to participate, have been discussed in an earlier paper[2]. The estimation of the food intake had to be based on one single 24 h dietary recall, as it was impossible to ensure the respondents' attendance at a second interview. These limitations have been kept in mind when interpreting the results.

The 24 h dietary recall supported the assumption that the drug addicts' meal patterns were highly influenced by their general way of living, in which improvisation was the main strategy in the continuous hunt for drugs. Comparison with the results of a survey from the Norwegian population (NORKOST) shows that the drug addicts' energy intake was lower than that of the general population by an average of 23 %[18]. The male addicts' energy intake was 30 % higher than that of the female addicts. This is consistent with findings relating to the Norwegian population at large, which have shown mean male energy intake of 11·5 MJ and female intake of 8·2 MJ[18]. Forrester *et al.*[19] found that energy intake among drug addicts could be linked to homelessness and sickness. Studies of hospitalised drug addicts without organic pathology have reported an energy intake of 38 % lower than that found in the present study, explained by abstinence and nausea[4]. Sickness and other kinds of indisposition may cause variations in eating activities. A reduced supply of essential nutrients over a prolonged period may in itself contribute to sickness and reduced well-being. However, investigations have revealed neural similarities between non-homoeostatic eating, i.e. eating considerably less or more than needed, and drug abuse[20]. Chronic stress, for instance food restriction, may increase the response to drugs[21]. This may explain to some extent why so many drug addicts (>50 %) in the present study had a low PALie. Such non-homoeostatic eating patterns may provide an unconscious reward by increasing the response to the drugs used, but an equally valid explanation is that addicts prefer an intensified drug experience at the cost of satiety.

The drug addicts' total protein intake was approximately 6 % lower than the values reported in the NORKOST study[18]. In the study of Forrester *et al.*[19] of HIV-negative drug abusers, an observed reduced protein intake was exchanged with a higher intake of carbohydrate-rich food which was provided by homeless shelters and soup kitchens. Investigations of hospitalised drug addicts without organic pathology have reported a similar mean intake of protein as found among our respondents[4]. Half of the respondents in the present study had a protein intake below the accepted maintenance requirement of 0·66 g per kg body weight per d[22]. The insufficient protein intake was, however, a result of low food intake.

The proportion of energy from fat fell within the recommended values of 25–35 % of total energy intake, although the absolute amount was low due to low energy intake[17]. The intake of PUFA, however, was lower than the recommended 5–10 %. Low PUFA intake has been linked to aggressive behaviour among substance abusers[23]. In the present study, 10–20 % of the respondents showed serum concentrations of total cholesterol, HDL and LDL that were lower than the reference values, which support the calculated low fat intake[24]. Low serum cholesterol values have also been linked to an increased risk of relapse during detoxification[23].

The relative carbohydrate intake was 60 (SD 17) E% of the energy intake, as recommended in the Nordic Nutrition Recommendation[17]. The percentage of energy derived from added sugar exceeded the maximum recommended amount by a factor of 3 compared to the recommended maximum of 10 %. An excessive intake of sugar by the drug addicts was also indicated by the findings that more than 20 % of the respondents showed TAG concentrations above the upper reference value and that more than 10 % had an increased HbA1c saturation. In addition, approximately 30 % had C-peptide concentrations exceeding the reference values. The drug abuse by itself cannot explain the increased concentrations of markers for general high glucose concentrations[25]. The high intake of added sugar could explain the low dietary content of fibre and essential nutrients[17].

Studies have focused on the increasing preference and craving for sweet food items in connection with drug addiction, especially among heroin addicts[26,27]. In the present study, 85 % of respondents had used heroin during the preceding 24 h[2]. Studies have also revealed a prolonged period of abstinence from drugs, when excessive amounts of sugar are consumed[26]. Besides, a high intake of sugar in itself could increase an individual's response to drugs[9]. The addicts' preference for sugar was observed, in that the food they bought themselves had higher sugar content than the food they received from charitable sources, friends and family.

Only 20–30 % of the respondents had an intake of vitamins and minerals above the RI[17]. The males had a higher overall intake of vitamins and minerals than the females, similar to the results of the NORKOST study[18]. The low intake of vegetables and fruit implied a low intake of antioxidants. The blood biomarkers supported the low reported intake by low concentrations of vitamin D and vitamin C. Low serum concentrations of vitamins E, C and A among drug addicts were reported in another study, which concluded that antioxidant therapy could increase the chances of rehabilitation and a healthier life among the drug addicts[7]. The high serum Cu concentration that was seen in one-third of the respondents can be explained by infections and agrees well with the findings of elevated C-reactive protein concentrations reported earlier[2].

The male addicts in the present study, who reported not getting enough to eat, had a lower intake of energy than those who were satisfied with their food intake. The female respondents who were not satisfied with the amount of food showed lower PALei than those who reported that they got enough food. Accordingly, their experience of not having access to sufficient food seemed real. However, one might discuss a practice of leaving food purchasing to the drug addicts themselves, i.e. giving them more money, since their own food choice showed poor nutrient density.

Conclusion

The results from the present study indicated a high risk of inadequacy of food and nutrient intake among heavy drug addicts, which seems to represent a health risk in itself. The drug addicts experienced limited access to food, and reported low food intake and unhealthy food choices. The dietary findings were supported by biomarkers. The food that addicts bought themselves was not as nutrient-dense as the food they received from friends/family and charitable organisations.

In the present study, the most striking features of the drug addicts' diets were the high intake of added sugar and the wide range of food amount intake. As presented previously, it has been documented that such dietary patterns and irregular eating may trigger inebriation mechanisms in the central nervous system, producing reinforced addiction and increased tolerance to drugs. It seems reasonable to assume that such dietary habits, together with the abuse of drugs, probably resemble a speeding roundabout, from which the addicts have the corresponding difficulties to jump off.

Further research on problems related to the diets of drug addicts should focus on both food content and dietary

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habits, and aim to uncover connections that may reinforce inebriation and addiction. Such connections, if neglected, can function as counter-productive forces in rehabilitation and treatment efforts.

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