Application of “Concept Mapping” in obese subjects: a pilot study in normo and underreporters

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SUMMARY

Background: One important step in nutritional education consists in identifying the patient prior knowledge in order to better educate him. The objectives of this pilot study, on twelve obese patients (6 underreporting patients — UR — and 6 normoreporting patients — NR) were to point out advantages and limits of a method: “concept mapping”, a graphic representation of the nature and organization of knowledge, and to show eventual cognitive differences between the two groups of patients.

Methods: Concept maps were drawed during interviews and analysed, considering the concepts, the links between them, their regrouping in knowledge fields. Concepts maps of UR and NR patients were compared.

Results: Our results confirm the advantages of concept mapping as the mean to explore the cognitive representation of patients. Some differences between UR and NR patients were readable on the maps: UR patients are more sensitive to the difficulties of the diet than the NR patients. UR patients tend to express more frequently their feelings or personal experiences, and to be more easily invaded by their feelings (more numerous links of personal expressions at UR patients).

Conclusion: Concept mapping brings new information on knowledge of obese patients. They appear important to better know the cognitive representations of underreporting patients. With such information, it would be easier for healthcare providers to adapt educational programs to the patients’ understanding, taking into account their misconceptions, errors and lacks of learning.

Key-words: Concept Map · Knowledge Organization · Eating Behavior · Underreporting · Diet · Obesity · Therapeutic Education · Cognitive Restraint.

SUMMATION

L’importance et l’organisation des connaissances des patients obèses. Elles ont été élaborées au cours d’entretiens, puis analysées en considérant les concepts, les liens, et les domaines de connaissances regroupant ces concepts. Les cartes conceptuelles des patients UR et NR ont été comparées.

Résultats : Nos résultats confirment l’intérêt des cartes conceptuelles comme moyen pour explorer les représentations cognitives des patients. Quelques différences ont été relevées sur les cartes des patients UR et NR: les patients UR seraient plus sensibles aux difficultés du régime que les NR. Les patients UR ont tendance à exprimer plus souvent leur ressenti ou leurs expériences personnelles, et semblent plus facilement influencés par ces émotions comme en témoigne l’importance des liens d’expression personnelle chez les patients UR.

Conclusion : La technique des cartes conceptuelles apporte des informations nouvelles sur les connaissances des patients obèses. Elles sont un moyen pour mieux connaître les représentations des patients sous-évaluateurs. A partir de ces informations, les soignants devraient être à même d’adapter les programmes d’éducation à la compréhension des patients en tenant compte de leurs conceptions erronées et leurs lacunes.

Mots-clés : Cartes conceptuelles · Organisation des connaissances · Comportement alimentaire · Sous-évaluation des apports alimentaires · Régime · Obésité · Éducation thérapeutique · Restriction cognitive.
Therapeutic education consists of making the patient acquire knowledge, know-how and of better managing the disease by facilitating the adoption of healthy behavior and by preventing complications [1]. Therapeutic education is a process favoring durable changes of habits and behavior in a permanent, voluntary and aware way. Therapeutic education requires a partnership between the patient and healthcare providers. The quality of the educational process depends on the caregivers’ consideration upon the objective and subjective needs of the patient. Beyond the dialogue and beyond the usual questioning, the caregivers should be able to investigate in the depth patients’ representations of health and disease. In this study, we have investigated obese patients’ knowledge, reasonings and life experience by means of “concept mapping”.

Nutritional education is a key issue in obesity management. A dietary inquiry is generally performed in each patient in order to individualize the dietetic information and prescription in agreement with the therapeutic guidelines [2]. This evaluation faces a major difficulty related to food intake underreporting. Many obese, and non-obese subjects tend to under-estimate their food intake. This phenomenon is associated to cognitive restraint: patients used to restrain consciously their food intake in order to control or decrease their weight, underestimate more frequently their daily energy intake, especially their lipid consumption [3-5].

This underreporting must be taken into account in the interpretation of the dietary survey and in the dietary counseling; underreporting and its determinants can lead to unsuitable, excessively restrictive dietary prescriptions [6].

In this study, we analysed the cognitive patterns of obese subjects taking into account the phenomenon of underreporting. The organization of the knowledge and the representations were studied using the technique of “concept mapping”, that is a graphic representation of the individual knowledge. The objective is to investigate the patients’ representations of their disease and to adapt the therapeutic education. Initially conceived by Novak and Gowin [7] to facilitate learning, the concept maps were used as tools for knowledge evaluation in various disciplines [8, 9] and recently applied to the field of therapeutic education [10]. They allow studying the nature and the organization of the knowledge before education, to describe the processes of learning following the education and to analyze the links between the organization of knowledge and the emotional factors.

The objective of this pilot study was to answer the following questions: which were the advantages and the limits of concept mapping for the identification of the cognitive characteristics of underreporting patients? Does concept mapping allow to show differences between the nature and the organization of the underreporting patient’s knowledge and those of the normoreporting patients? Taking into account the limited number of patients included in the protocol, and on the other hand, the high number and the variability of items analysed, this research should be considered as a pilot study. The objective is to improve the analysis of the educational needs of the obese patients and try to understand the underreporting phenomenon.

**Methods**

The research was conducted in the Department of Medicine and Nutrition of Hôtel Dieu Hospital, Paris (Pr B. Guy-Grand). This service develops educational activities for obese patients during week or day hospitalizations. Following an initial dietary interview with the diettian, the patient participates to dietary courses, cooking workshops, etc. An individualized dietary prescription is then proposed to the patient.

**Population**

In the absence of previous data in this field, we were not able to build up an hypothesis testing sample size calculation. It was decided arbitrarily to study a group of 12 subjects.

The population was selected among consecutively referred subjects attending the outpatients clinic of the department of nutrition in Hôtel Dieu Hospital. Twelve patients were included on the following inclusion criteria.: obese woman (BMI > 30kg/m²), aged between 25 and 65 years, with stable weight or gaining weight, attending the department for the first time; no previous work analysis of the underreporting, absence of major associated disorders (bulimia, anorexia nervosa, alcoholism, depression, somatic or psychiatric diseases). Underreporting was defined according to the previously described method [3, 11]. Underreporters are subjects not loosing weight, with a daily energy intake/energy expenditure ratio equal or lower than 1,05. The resting energy expenditure (REE) is calculated according to the equation of Schofield [12]. Daily total energy expenditures derived from the REE and the ratio of daily energy expenditure/REE defined by FAO/WHO/UNU [13]. The diagnosis of underreporting was established by the physician and the dietitian in charge of patient care. The groups of underreporters and non underreporters were set consecutively, that is when the first patients UR or NR were included. In the first phase of the study, that is the elaboration of the concept maps, the status of the patients was unknown of the researcher. During the second phase the investigator was aware of the reporting status to analyse the concept maps.

**Elaboration of the concept maps**

The patients underwent thirty minutes interview during which a concept map was drawn up. The method was the following: from the central concept “diet” registered in the middle of a large blank page, the patient was invited to ex-
First phase of analysis

First, the concept maps were analyzed in keeping with predetermined indicators, whatever the patient’s status (under or normoreporter). The objective was to sum up various parameters of analysis previously validated [10]. In order to describe the nature and the organization of the patient’s knowledge, the following factors were considered:

- the number and the nature of the first concepts expressed spontaneously by the patients from the central concept (or first level concepts);
- the number and the nature of the superordinate concepts. According to Ausubel’s theory of the hierarchical organization of knowledge [14], a superordinate concept is a wide, general concept, related with a variety of subordinate concepts. For example, “food” is a superordinate concept that contains subordinate concepts such as “fat, sugar, calories etc”. Superordinate concepts are those concepts that generate the majority of links in each of the concept maps. In the construction of knowledge, the superordinate concepts play an important organizing function of the knowledge. In the field of therapeutic education these concepts often reflect the preoccupations of the patients [10];
- the number and the nature of the “knowledge fields”. A knowledge field is bounded by a set of ideas (concepts and links) on the same topic [7, 15]. They identify in a synthetic way the nature of the knowledge of the patient;
- the total number of concepts and links yield quantitative information on the abundance of knowledge;
- the number and the nature of the links connecting the concepts were classified into four groups as proposed in previous studies on therapeutic education [10, 16]: 1) General expression links: explanations, rules, associations, examples such as “for, as, it is one, because, it is rather one, because of”, etc. 2) Cause and effect links expressed as: “provoked by, it looks like, entails, brings in” etc. 3) Ways of behaving links (preventive or therapeutic behaviors) such as: “it is necessary to do so, it is necessary to avoid, I take”, etc. 4) Personal expression links expressing opinions, faiths, values: “I feel, I need, for me, rather”, etc;
- the nature of the expressed knowledge was divided in two main categories to classify the way the patient appropriates or contextualises his knowledge [10]: 1) Declarative or factual knowledges express theoretical facts, main rules, examples, associations which are not directly related to the patient’s knowledge. 2) Other types of knowledge have been acquired by the experience and depend on the patients context (“dieting is difficult when have got the blues”), or result from conditional knowledge (“when one is on a diet, it is necessary to pay attention to the food”, etc.), or indicate a linkage of several concepts (“dieting is demanding because weight loss takes time”), etc.

Each map was analyzed using these indicators. All the obtained information were put back in a summary table.

Second phase of analysis

This second phase of analysis looked at the patient’s concept maps according to their status of normoreporter (NR) or underreporter (UR) [11]. The following indicators were compared:

- the average number of first concepts, superordinate concepts, knowledge fields;
- the average total number of concepts and links;
- the nature of: the first expressed concepts (identification of the knowledge fields to which they belong), the links, the superordinate concept, the knowledge fields and the knowledge categories;
- the most and the least developed knowledge fields.

Results

Sample characteristics

Our sample included 12 obese female patients in two groups: underreporters (UR) and normoreporters (NR), aged between 31 and 62 years. Extreme values of body mass index were 30 to 61 Kg/m². All were in stable weight or in a period of weight gain. None has lost more than 3 kg during the last three months or followed a low caloric diet. These patients had never been admitted in the department before and had ever been told about underreporting of food intake.

Analysis of the concept maps

In this first phase, the patient status (UR or NR) was not known by the investigator.

Example of analysis of a concept map

We present the analysis of a concept map obtained with a female patient (n° 6) (Fig 1). The Table I summarizes all the information included in the concept map. Spontaneously, this patient expressed two concepts: “limitation” and “to reduce something”. The superordinate concepts tracked down in its map are: “limitation” (knowledge field “constraints” to which belong both first concepts) and “sport” (3 links leave these concepts). Seven knowledge fields were identified (as in the majority of the patients). The most developed field was “constraints” (limitation) with a number of predominant concepts and links (respectively 5 and 6). Indeed, this patient associates to the notion of diet the necessary limitation of the food which she eats most. She expresses this

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in her verbatim by: “I eat a lot of chocolate”. The patient expressed a total of 16 concepts and 18 links. Among these last ones, 11 express generalities, 6 personal opinions, 1 a “way of behaving” describing therapeutic action. The majority of the knowledge is declarative (14/18) while only 4 knowledges seem connected with the context of the patient or let appear the conditions of an action.

Analysis of the concept maps according to the statutes of normo (NR) or underreporting (UR)

The average numbers of knowledge fields and superordinate concepts organizing maps are the same for both groups of patients. The average number of first concepts expressed by UR patients is slightly superior to that of NR patients (6 and 4). The knowledge of both groups is essentially declarative (more than 80% of the expressed knowledge) (Tab II). The nature of the links differs on one point: the personal expressions are more frequent at the UR patients than to the NR patients (respectively 27.9% and 14% of the expressed knowledge). 13 knowledge fields were identified in the patient’s concept maps (Fig 2). 7 of them are found almost systematically. The field “conditions making the diet effective” is found in 5 patient’s (4 NR patients and 1 UR patient). Only 2 patients evoked the field: “benefit of the diet for the well being”. Finally, four other fields are evoked only by a single patient, two fields by UR patients and two others by NR patients.

In both groups of patients, first level concepts are included to the following knowledge fields: “constraints” (5 times on 6), “characteristics of the diet” (4 or 5 times on 6), “self image” (twice on 6). UR patients express twice more than NR patients first level concepts in the following fields: “benefit of the diet for health” and “the difficulties of the diet” (4 times for UR and twice for NR for the first domain, twice for UR and once for NR for the second domain). Only UR patients evoke first level concepts belonging to fields: “benefit of the diet for the well being” and “physical activity”. On the other hand, the NR patients express more con-
cept in the field “conditions making the diet effective” (2 for the UR and 1 for the NR patients).

Superordinate concepts were mainly related to the field “constraints”. In half the NR patients the superordinate concepts belong to the field “conditions making the diet effective” (none for UR patients). In 4 UR patients the superordinate concept belongs to the field “benefit of the diet for health” (vs 1 NR patient). Only the UR patients express a superordinate concept which belongs to the field “benefit of the diet for the well being”.

“Characterization of the diet” and “constraints” are two knowledge fields particularly developed in 2 patients in each of the two groups. UR patients or NR patients differ for other fields: UR patients are concerned by: “benefit of the diet for health” (1 patient), “difficulties of the diet” (1 patient), “benefit of the diet for the well being” (1 patient); NR are concerned by “conditions making the diet effective” (2 patients). Both UR and NR patients are concerned by the: “characteristic of the not diet” (4 NR and 5 UR), and “benefit of the diet for the image of himself” (2 NR and 3 UR).

**Discussion**

This pilot study aimed at analyzing the organization and the nature of the knowledge of obese subjects. By organization, we mean the hierarchisation of the different concepts composing the knowledge, the regrouping of these concepts in meaningfull knowledge fields, and the cross links be-

### Table I

Analysis of an individual concept map.

<table>
<thead>
<tr>
<th>Patient N°</th>
<th>First concept</th>
<th>Superordinate concept</th>
<th>Knowledge fields</th>
<th>Number of concepts</th>
<th>Number of links</th>
<th>Nature of the links</th>
<th>Knowledge categories</th>
</tr>
</thead>
<tbody>
<tr>
<td>1° Limitation</td>
<td>Limitation (3 links)</td>
<td>Constraints</td>
<td>5</td>
<td>6</td>
<td>4 general expr</td>
<td>2 declaratives</td>
<td></td>
</tr>
<tr>
<td>2° remove something</td>
<td>Sport (3 links)</td>
<td>Physical activity</td>
<td>3</td>
<td>3</td>
<td>2 general expr</td>
<td>3 declaratives</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Diet difficulties</td>
<td>2</td>
<td>3</td>
<td>1 general expr</td>
<td>2 declaratives</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Characterisation of diet</td>
<td>2</td>
<td>2</td>
<td>1 general expr</td>
<td>1 declaratives</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Health benefits of the diet</td>
<td>2</td>
<td>2</td>
<td>1 general expr</td>
<td>1 declaratives</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Characterisation of no diet</td>
<td>1</td>
<td>1</td>
<td>1 general expr</td>
<td>1 declaratives</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Benefit of diet for self image</td>
<td>1</td>
<td>1</td>
<td>1 declaratives</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2</td>
<td>2</td>
<td>7</td>
<td>16</td>
<td>18</td>
<td>11 general expr</td>
<td>14 declaratives</td>
</tr>
</tbody>
</table>

General expr: links of general expression; C & E: cause and effect links; Way of beh.: ways of behave links; Pers. Exp.: links of personal expression.

### Table II

Nature of the links and knowledge categories for every group of patients.

<table>
<thead>
<tr>
<th>Nature of the links</th>
<th>UR</th>
<th>NR</th>
</tr>
</thead>
<tbody>
<tr>
<td>General expressions</td>
<td>20.6 (60.7%)</td>
<td>23.7 (72.7%)</td>
</tr>
<tr>
<td>Cause and effect</td>
<td>1.2 (3.4%)</td>
<td>1.3 (4%)</td>
</tr>
<tr>
<td>Ways of behave</td>
<td>2.7 (7.8%)</td>
<td>3 (9.2%)</td>
</tr>
<tr>
<td>Personal expression</td>
<td>9.5 (27.9%)</td>
<td>4.6 (14.1%)</td>
</tr>
<tr>
<td>Average number of links</td>
<td>34</td>
<td>32.5</td>
</tr>
<tr>
<td>Knowledge categories</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Declaratives</td>
<td>27.3 (80.4%)</td>
<td>27.5 (84.6%)</td>
</tr>
<tr>
<td>Others</td>
<td>6.7 (19.6%)</td>
<td>5.16 (15.8%)</td>
</tr>
<tr>
<td>Average number of knowledge</td>
<td>34</td>
<td>32.5</td>
</tr>
</tbody>
</table>

The percentage are calculated on the total number of knowledge or links for the 6 patients of each groups.
used a technique of evaluation recently introduced in the field of therapeutic education: “concept mapping”. Our specific objective was to appreciate the influence of a characteristic of the eating behavior (underestimation of food intake) on the nature and the organization of the knowledge. We conducted a qualitative pilot study on a limited number of cases. As a consequence, only tendencies can be discussed here; no statistical analysis is allowed on a limited population. An other limitation is that the information from concept maps may be influenced by the researcher’s effect on interviews. In fact, as we have already underlined, the concept map is a graphic representation of a part of a patient’s knowledge, expressed at a given moment in a definite context to a given investigator [10, 16]. It means that depending the conditions (moment, context, methodology of elaboration of concept map, investigator) the picture of concept map is modified [21]. Variation between concept mapping have been observed for example before and after education [10]. But the influence of the investigator on the expression of the knowledge by a patient during an interview is not yet fully documented.

The concept maps realized in this study clearly underline the narrow relations between the cognition (knowledge) of the patients and their feelings about dieting. This is in keeping with previous observations in diabetics patients [10, 22]. Indeed, even if the initial objective of concept mapping is to enlight a structured expression of a person’s knowledge on a given topic (from which the important development of the knowledge field “characterization of the diet”), this verbalization is always more or less influenced by the patient’s experiences and feelings. For example the knowledge field “benefit of the diet for the image of himself” appeared in 10 maps out of 12.

UR patients tend to express more frequently their feelings or personal experiences, and to be more easily invaded by their feelings (more numerous links of personal expressions at UR patients) than NR. The notion of “constraint” was associated to “diet” in all the patients, either UR or NR patients. In NR patients, constraint structures the other knowledge more often than in UR patients. Constraint is closely connected to a knowledge field particularly developed in NR patients: “the conditions making the diet effective”. This knowledge field corresponds to a superordinate concept only in the NR patients. This finding supports the hypothesis that NR patients are more focused on the application of the diet. On the other hand, UR patients are more likely to evoke the benefit of the diet for health or its benefits for the well being. In other words, UR patients do perceive the objectives of a diet, but they seem to be less prone to look for the means to reach them. In the same way, the knowledge expressed in the field: “difficulties of the diet” differ in their contents in UR and NR patients. The UR patients express difficulties associated with “food temptations”, “greed”, “slow weight loss”, “breaking down” and “lack of will”. Furthermore, they underline the problems, which they meet to go shopping and to prepare two different meals (for them and for their family). NR patients evoke more often difficulties to follow a diet in a professional environment, but also the dietary dullness and the problems of practical organization of their diet. This seems to indicate that the UR patients are more sensitive to relation of dieting with the psychoaffective field than the NR patients. UR patients tend to express more frequently their feelings or personal experiences, and to be more easily invaded by their feelings (more numerous links of personal expressions at UR patients) than NR.

It is well recognized that changing the nutritional habits is a hard task, especially in obese subjects. Studying the nature and the organization of the knowledge is a key issue to adapt therapeutic education to the patient’s characteristics. This approach adds a new dimension to the investigation of behavioral characteristics of the obese patients. Education strategies should take into account the links between the organization of knowledge and the emotional factors. “Concept mapping” appears to be a promising tool to improve to
investigate the patient’s representations in the domain of obesity as previously reported in other fields of therapeutic education [8, 9].

**Conclusion**

In this qualitative pilot study, concept mapping has been tested as a way to investigate the organization and the nature of knowledge subjects. The advantage and the limits of the technique have been identified. Compared with the diet survey, the major advantage of the technique of concept mapping is the possibility to collect information in a more spontaneous way without predetermined frame of answer. The technique of concept mapping yields a more subtle approach of all the aspects of the patient’s verbatim than a classic dietary survey. The analysis of cognitive characteristic of UR patients indicates a tendency to some differences between NR and UR obese patients. UR patients are more sensitive to the difficulties of the diet than the NR patients. UR patients tend to express more frequently their feelings or personal experiences, and to be more easily invaded by their feelings (more numerous links of personal expressions at UR patients) than NR. More research is requested using concept mapping to explore cognitive structured of knowledge on a more important number of obese patients, particularly to explore lack of learning and misconceptions.

**References**