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DYSLEXIA AND DEPRESSION IN CHILDREN: A CROSS-SECTIONAL STUDY IN A MOROCCAN POPULATION

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Mohsine Yassari — Department of psychiatry, Faculty of Medicine and Pharmacy, University Sidi Mohamed Ben Abdellah, of Fez, Clinical neurosciences Laboratory, Faculty of Medicine and Pharmacy, University Sidi Mohamed Ben Abdellah, Fez, Moulay Ismail Military Hospital, Meknes.

Khalid Mouhadi* — Department of psychiatry, Faculty of Medicine and Pharmacy, University Sidi Mohamed Ben Abdellah, of Fez, Clinical neurosciences Laboratory, Faculty of Medicine and Pharmacy, University Sidi Mohamed Ben Abdellah, Fez
*Corresponding Author
kmouhadi@yahoo.fr

Hicham Bousbaa — Moulay Ismail Military Hospital, Meknes.

Chadya Aarab — Department of psychiatry, Faculty of Medicine and Pharmacy, University Sidi Mohamed Ben Abdellah, of Fez, Clinical neurosciences Laboratory, Faculty of Medicine and Pharmacy, University Sidi Mohamed Ben Abdellah, Fez

Rachid Aalouane — Department of psychiatry, Faculty of Medicine and Pharmacy, University Sidi Mohamed Ben Abdellah, of Fez, Clinical neurosciences Laboratory, Faculty of Medicine and Pharmacy, University Sidi Mohamed Ben Abdellah, Fez

Ismail Rammouz — Department of psychiatry, Faculty of Medicine and Pharmacy, University Sidi Mohamed Ben Abdellah, of Fez, Clinical neurosciences Laboratory, Faculty of Medicine and Pharmacy, University Sidi Mohamed Ben Abdellah, Fez

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ABSTRACT:

Dyslexia is a neurodevelopmental disorder that affects 5 to 10% of children of school age, especially bilingual children.

The aim of this work is to describe the characteristics of dyslexia in our Moroccan context, to determine the specificities of dyslexia in bilingual children and to screen and describe depressive disorders in dyslexic children.

This work is a cross-sectional study over a period of 5 months which include 32 children seen in center of speech therapy in three different cities. After the signature of the consent, all children were assessed according to a standardized procedure, including the collection of anamnestic data, clinical data, a mood assessment with CDRS (Children Depression Rating Scale)

Thirty two patients were included. The average age of the patients is 11.1 +/- 2.84. The sex ratio M/F is 1.90. As for the educational level of the parents, the majority of them had a high level of education (80%). A history of severe or chronic disease was rare in our sample (only 4 cases). The families have chosen to be examined in 46.5% whereas in 53% of the cases it was the school that suggested Health professionals. The approximate date of the first visit was 3.31 +/- 3.29 years.

In 50% of cases, dyslexia was phonological, lexical in 31.3% of cases and mixed in 18.8% of cases. The prevalence of depression was 28.1%, and there is a statistically significant link between age of mothers and the type of dyslexia ($p = 0.02$)

The management of dyslexia begins with the sensitization of teachers. The intervention of practitioners must take into consideration the different clinical aspects of dyslexia and the depressive component.

INTRODUCTION:

Dyslexia is one of the new clinical and therapeutic challenges facing pediatricians, psychiatrists and general practitioners. On the one hand, because with prevalence estimated between 2 and 17.5% of school-aged children, dyslexia is one of the most common neuro development disorders in the population [1]. On the other hand, reading is today not only the basis of school learning, but also an indispensable tool in the daily life of a society where written and spoken language is of paramount importance. The educational and socio-economic handicap that dyslexia engenders can therefore be major in the most severe forms completely preventing access to the written code.

For clinicians, it is important to know the variety of clinical situations in which learning disorders in general and dyslexia in particular may be involved.

In fact, in the face of an anxiety disorder, depressive syndrome or opposition behavior in schools, the practitioner must think about exploring the path of learning disorders.

It can also be requested in the context of the impact of these disorders on school performance, or as part of the evaluation of the psychopathological context but also psycho-cognitive. He will then be the evaluation coordinator and the prescriber of care and re-education.

The facets of dyslexia have been sufficiently studied in the northern countries, but they are less so in emerging countries, especially in bilingual children, as in the case of Morocco, where children from the age of 5 begin to learn the language, Arabic and French language at the same time. And since studies are rare in these countries, we have seen the interest of undertaking a work which will have as objective to describe the socio-demographic, clinical

characteristics of dyslexia in the context of a Moroccan population, and to detect depression in this population by trying to find the links between dyslexia and depression, and by hypothesizing that dyslexics would have academic and social difficulties to integrate.

Methods

Our study is cross-sectional descriptive and analytical focused on a group of children with dyslexia, over a period of six months from November 2016 until April 2017.

Study cases

Children were recruited for consultation in child psychiatry or speech-language centers in three different cities; Fez, Rabat and Casablanca. Diagnosed children with dyslexia were included using a speech-language pathology assessment, and from the follow-up medical file confirming the diagnosis of dyslexia, in children aged 8 to 17, whose parents agreed to participate in the study after signing the consent. Children with intellectual, hearing or visual disabilities were excluded.

The data were collected on an exploitation sheet comprising a hetero-questionnaire, specifying socio-demographic parameters (age, sex, geographical origin, level of study, socio-economic level), clinical data (somatic and psychiatric personal history, Psychomotor development as well as family history, first consultation, and treatments undertaken.

The questionnaire also included the parameters related to schooling (age of beginning of schooling and the structure of schooling and the current class as well as the motivation and the school results of the child).

Psychometry

To evaluate depression, we used the Children's Depression Rating Scale (CDRS), which is a questionnaire modeled on the Hamilton Depression Rating Scale, considered a Gold Standard for the assessment of depression since 1960 [2]. The CDRS is a clinical interview tool designed to assess depressive states in children aged 6 to 12, as well as adolescents. For children aged 4 to 6, it is up to their parents to answer the different questions. The CDRS contains 16 items, and the higher the score, the more serious the depression. Thus, a score greater than 30 indicates the presence of depression, a score between 20 and 30 is in favor of a probable depression, and a score below 20 suggests the absence of a possible depressive disorder [3,4].

The Arabic version of the CDRS was used in a study conducted at Rabat-Salé Hospital, El Ayachi Hospital, and is characterized by good psychometric properties [5].

The speech therapy assessment

The orthophonic assessment was carried out in 3 phases: an initial phase (complaint and anamnesis), a phase of tests, then a final interview (hypotheses and / or diagnosis and decision)

The initial interview collected the pathological antecedents specific to the patient, the family antecedents concerning language and learning, (language acquisition, babbling, first words, first sentences), the history of disorders of the child, the dates of their appearance, the possible repercussions, the general antecedents, the age of the different acquisitions of the child.

Through the initial interview, the speech-language pathologist was able to determine and select the written and oral language tests and use test batteries based on the patient's age and grade level. These tests and their results were used to highlight the language problems, to objectify them and to make a diagnosis, or to confirm the diagnosis already made by the health care team. The evaluation made it possible to observe the evolution of the patient and decide on the continuation of the treatment.

The final interview, the last stage of the assessment, allowed the speech therapist to give back to the patient and his parents the results of the technical tests orally.

Statistics

The data has been entered and coded on Excel. Then statistical analysis was performed using Epi-Info software version 2003 and SPSS software (version 17). The qualitative variables were described in terms of proportions and the quantitative variables in terms of mean, extreme values and standard deviation. The association between depression and several potential explanatory variables was sought through classical parametric tests (Khi2 test, Student's test, ANOVA).

The test is considered significant when p (degree of significance) is less than 0.05.

Ethical aspects

After explaining the objectives and protocol of the study, a statement of consent to participate in the study was completed and signed by the parents of the children.

Results:

Descriptive results

Our study included 32 children diagnosed with dyslexia whose mean age (+/- standard deviation) was 11.1 years +/- 2.848, a minimum of 7 years and a maximum of 17 years old. Male overrepresentation was noted with 21 boys (65.6%) and 11 girls (34.4%). The average age of fathers was almost 49 years +/- 7.155, with a minimum of 40 years and a maximum of 67 years. For mothers, mean age (+/- standard deviation) and 41.5 years +/- 5.78, with a minimum of 31 years and a maximum of 58 years. 31 of the surveyed parents were married (96.6%) and one of the mothers was widowed (3.1%).

Parental marriage was inbred in 25% of cases and not inbred in 75% of cases. 30 children live with both parents (96.9%), while only 2 children live with their mothers.

In terms of fathers' level of education, 6.3% had a primary education level, 3.1% were illiterate, 22% had a high school education, and 59.4% had a university level. For mothers, it was found that 28.1% had a university level of education, while 9.4% were illiterate.

Regarding the professional activity of mothers, 50% of the mothers had a job, of which 22% had a full-time job, 15.6% a part-time job and 6.3% a casual job. 19% of working mothers had an income between 2000 DHS and 5000 DHS. 12.5% had an income between 5000 and 10000 DHS, and 9.4% had an income <2000 DHS.

The average age of mothers during pregnancy was 30 years +/- 6.12 with a minimum of 20 years and a maximum of 46 years. The average age of fathers during pregnancy was 38 years +/- 6.84 with a minimum of 28 years and a maximum of 55 years. 29 of 32 pregnancies were desired (90%) and 3 were unwanted, and deliveries were completed in 31 cases, while there was only one case of prematurity.

These deliveries were vaginal in 23 cases (72%), and high in 9 cases (32%). Regarding psychomotor development, the median age of the head was 5 months with an interval between 1 and 12 months, while the sitting position was acquired on average at the age of 7.8 +/- 2, 9 months with a minimum of 4 months and a maximum of 12 months. The average age of walking was 14 +/- 5.5 months with a minimum of 9 months and a maximum of 36 months, for language the average age of language acquisition was 22.8 months +/- 10.27 months with a minimum of 12 months and a maximum of 48 months. For sphincter control, the mean age of acquisition of ureteral sphincter control was 30 months +/- 9.07 months with a minimum of 12 months and a maximum of 48 months, and for the anal sphincter, acquisition Sphincteric control was at the average age of 30 +/- 7.69 months with a minimum of 12 months and a

maximum of 48 months. Regarding personal history, we found a child who had a GH deficiency, another operated on a neurofibroma, a case of asthma, a single child with documented depression.

Three cases of dyslexia in the family were revealed in the children interviewed (10%), two cases in mothers and one case in a brother.
The beginning of schooling was on average at the age of 5 +/- 0.96, with a minimum of 4 years and a maximum of 7 years. 22 children had changed the sector of schooling (from a public school to a private school), which was 81% taken by the family and in 12.5% of cases proposed by a teacher or recommended by a doctor in 2 case.
90% of the children had a bilingual education, while two children had the Arabic language or French only as the language of instruction.

Teachers had already summoned the parents of 26 children (81.3%) for several reasons, including learning disabilities in 56% of cases and hyperactivity in 22% of cases.

Clinical data

The date of the first consultation was at the average of 3,31 years +/- 3,29 with a maximum there are 11 years and at least a year ago.

The learning disability was the reason for consultation in 84.4% of cases, while hyperactivity was the reason in 12.5% of cases, and only one child consulted for a concentration deficit.

Families had chosen to consult themselves in 46.5% while in 53% of cases, it was the school that the opinion of health professionals had proposed.

In 53% of the cases, the speech therapists had made the diagnosis, and in 43% of the cases, it was the psychiatrists whereas a neurologist had made the diagnosis in only one case.

30% of cases had a history of AD / HD (7 children), 6.3% of children had either sleep disturbances or enuresis, while 3.1% of children had motor coordination disorders or dyscalculia.

Dyslexia

The speech therapy assessment showed:
22 of the children omitted (69%).
22 of the children added (69%).
22 of the children had auditory confusion (69%).
16 of the children had visual confusion (50%).
16 children had adjustment errors (50%).
22 of the children had lexicalization errors (69%).

In 50% of cases, dyslexia was phonological, lexical in 31.3% of cases and mixed in 18.8% of cases.

Psychiatrists participated in PEC of children in 40.6%, while speech therapists participated in 96.9% of cases.

All children received speech therapy, while 21.9% of children received psychotherapy and 31.3% of children received psychomotor therapy and only one child received psychopharmacological treatment.

The Depression

The total score of the depression scale was between 13 and 44, with an average (+/- standard deviation) of 25.22 (+/- 7.83).

Nine of our patients (28.1%) had a significant depression score, 15 (46.9%) had a probable depression, while 8 patients (25%) were unaffected.

Analytical results:

For dyslexia types, no significant association was found between type of dyslexia and clinical, sociodemographic, and dyslexia history except for parent's age (see chart), where there was a significant association between the types of dyslexia and the age of the mothers ($p = 0.020$), (see Table 1). Similarly, no significant association was found between depression scores, clinical and socio-demographic factors, and the presence of dyslexia. (See Table 2)

Similarly, for the relationship between the types of dyslexia and the reason for consultation on the one hand and the management of dyslexia on the other hand, it could not be demonstrated statistically.

DISCUSSION

Specific learning disorders Studies (TSAs) are rare in Morocco. Indeed, interest in these disorders in our country dates back only a few years.

Recall that the purpose of our work is to describe the peculiarities of dyslexia in our Moroccan context in bilingual children and to detect depressive disorders and the possible interactions between dyslexia and depression.

Our results show that they are broadly comparable to the results of foreign studies.

The average age of our patients was 11.1 years +/- 2,848. This value is close to those found in most studies of the literature, and this shows the recent interest in this disorder in primary schools.

In our series, there was a clear male predominance with 21 boys (65.6%) and 11 girls (34.4%), and this corroborates with data from the literature, dyslexia is more common in boys than in men. girls with a sex ratio of 2 to 3 boys for 1 girl, and also with the study of T. Leonova with 63 boys and 37 girls [1]; and the study conducted in an Indian population of S. Bandla, et al [7] with 23 boys and 7 girls. But also in the Spanish study of JE. Jiménez we note the male predominance with 22 boys and 13 girls. But disagreeing with our study, Z. Mimouni's study [8] found that boys and girls were equally represented in 18 boys and 20 girls.

The cultural peculiarity in our context would explain this observation better by the fact that the neglect of learning difficulties for girls in certain circles, especially the most disadvantaged, where we think that the girl, even if she does not succeed her schooling will eventually get married at an early age or, if so, learn housework.

Contrary to our results, data from the literature found that learning disabilities would be more frequently encountered among children from the underprivileged classes, notably in the study of Billard C. in 2010 [9] and in the Egyptian study of Mona M. et al in 2016 [10] who reported that 75% of dyslexic children in the study came from a low socioeconomic region, and in the Tunisian study of Missaoui S, which had shown that dyslexic children were from disadvantaged backgrounds. However, in these last two studies, selection bias would have been present, since recruitment took place in public health institutions, where probably the poorest families who would have presented themselves in the hope of help for their children while the wealthier families would have turned to private institutions.

Family history of dyslexia was rare in our sample (only 4 cases). This is similar to the results of a cohort study conducted in 2007 by C. Billard [11] who showed that the antecedents were rare and identical in 2 groups of children with and without learning

difficulties. This genetic component of dyslexia is confirmed by data from monozygotic and dizygotic twins in the De Fries et al [12] study. The study conducted by Z. Mimouni in 2006 found that 74% of dyslexics report the presence of a family member experiencing reading difficulties while 76% of them report a case of writing difficulties. The finding of the rarity of family cases in some studies comes from the fact that this disorder was ignored and / or misdiagnosed in our context.

In our study, Families consulted in 46.5% whereas in 53% of cases it was the school that suggested the opinion of health professionals; learning disability was the reason for consultation in 84.4% of cases, hyperactivity in 12.5% of cases. Whereas in the French study conducted by J.C. Cuvillier, et al [13] in 2002, the first signs were observed in 82% of the cases by the teacher and in 12% by the family; learning disability was the reason for consultation in 80% of cases and hyperactivity in 2% of cases.

Teachers can both, based on the behavior of the child in the classroom, hypothesize an ADHD disorder, but also judge the cognitive abilities of the child when faced with elementary learning, such as reading and numeracy, indicative of a specific learning disability, hence the major interest in educating teachers about the screening and orientation of dyslexic children.

In our series, half of the cases dyslexia was phonological, lexical in 31.3% of cases and mixed in 18.8% of cases. These data are consistent with the results found in the I study. Soares-Boucaud [14] who had established a clear predominance of phonological dyslexia 70% followed by mixed dyslexia 20% and dyslexia of surface or lexical 10% and also joined the study of Seymour (1986) [15] which had phonological dyslexia was observed in 85% of cases, lexical dyslexia in 10% of cases and 5% of children had mixed dyslexia.

On the other hand, other studies had objectified the predominance of mixed dyslexia as in the M-P study. Lemaitre [16] where mixed dyslexia was present in 100% of cases. These results were confronted with data from INSERM that show that almost all dyslexia are mixed.

In our series psychiatrists participated in the PEC of children in 40.6%, speech therapists participated in 96.9% of cases. Five children attended psychotherapy sessions and four were treated by a neurologist All children received speech therapy, while 21.9% of children received psychotherapy and 31.3% of children underwent psychomotor re-education, and one child had received psychopharmacological treatment.

These data are close to the study of Kourdane et al [17] who objectified a speech therapy follow-up for 94.9% of the patients whereas in the study of JC Cuvellier in 2004, just 43% of the children had benefited from a speech therapy, 27.5% of psychotherapy and 13.5% of psychomotor rehabilitation. And according to Z. Mimouni Children experiencing dyslexia are referred to speech therapists in 40% of cases, neuropsychologists in 40% of cases, psychologists in 70% of cases or resource teachers in 80% of cases to undergo assessments and possibly for clinical therapy or educational intervention.

According to Soares-Boucaud et al [18], the management of dyslexia is essentially based on speech therapy, articulated if necessary with other rehabilitations, sometimes an orthoptic (in the case of visual strategy disorders), more rarely a psychomotricity or occupational therapy. Rehabilitation methods are still empirical and have not been validated scientifically.

No drug therapy has currently been shown to be effective. Often multidisciplinary care with associated psychological support is essential. These treatments for developmental dyslexia often last for many years.

Regarding the second part of our work, namely depression in dyslexics, researchers are more and more interested in this subject, for example Carroll JM, et al 2005 [19]; Maughan et al 2003 [20]; Willcutt and Pennington et al [21], Miller et al [22]. Nevertheless, the first studies of internalized problems and depression in people with reading impairments were conducted in the 1980s and later, Casey, Levy, et al, 1992 [23].

The results showed that children with dyslexia were more anxious and had depressive symptoms than peers without dyslexia. In our study nine of our patients (28.1%) had an established depression, 15 (46.9%) had probable depression, while 8 patients (25%) were unaffected. These figures are consistent with the results of the Maughan et al [20] flagship study [20] that investigated the association between reading and depressed moods in a sample of 1416 boys aged seven to ten years of age. longitudinal follow-up.

The presence of dyslexia is associated with a markedly higher rate of depression than in control subjects at the first visit (9.6% in controls and 23% in dyslexics).

According to Julia M. Carroll's study, depression was present in 2.3% of children who had dyslexia versus 1.8% in a control group.

This study compared 28 dyslexic children with 39 children in the control group and was based on parental assessments. A few years later, the results of another study improved our understanding of depression in people with dyslexia by comparing measures of depression in children, adolescents, and adults with dyslexia in a cross-sectional study. A Boetsch, et al [24] showed that children and adolescents had high levels of depression compared to the control group.

On the other hand, in dyslexic adults, the degree of depressive symptoms was comparable to the control group, and so it seems that with age, dyslexic children feel less depressed and that school and competitiveness with classmates or poor school performance are likely to be key determinants of depression in dyslexics.

Willcutt and Pennington [25] in a study comparing behavioral problems in twins with and without dyslexia, found that girls had higher levels of depression than boys. These results take into account those found by MC Dekker, et al [26] and by Piccinelli and Wilkinson [27] who found that girls had higher levels of depression than boys, and this refers to the classic epidemiological data of depression that have proven that the sex ratio of depression is ½.

Although of small size, the interest of this work comes from the fact that it is the first realized in Morocco, by describing the clinical characteristics of the dyslexia, and by analyzing risk factors involved in the disease, and by putting the point on frequency association of dyslexia with depression.

CONCLUSION:

The psychological impact of dyslexia is manifested by an increased risk of associated depressive disorders in these children.

The diagnosis, prevention and multidisciplinary care of these disorders must be an integral part of their care.

The challenge for the doctor lies in understanding the complex clinical picture presented by these children. This understanding can be obtained only through an open and comprehensive approach, neglecting neither family socio-psychological factors nor psychological factors and more particularly depression.

The device of care is multidisciplinary begins first by the teacher by its role of screening and orientation, then thereafter, the general practitioner, the pediatrician or the child psychiatrist must confirm the diagnosis and then a third channel that includes the speech therapist and the psychotherapist. The establishment of adapted care, specific rehabilitation and personalized educational facilities to alleviate the psychological impact will then allow the child to find his place in the education system and prevent depressive complications.

Table 1: Analytical results by type of dyslexia

The variables studied	Types of dyslexia						P
	Phonological		lexical		Mixed		
Age : (average +/- standard deviation)	10	+/-2	10+ /- 3		9+ /-3		0,085
Sex *Male *Female	4 12	(50%) (50%)	3 7	(37%) (30%)	1 5	(12,5%) (20%)	0,837
Mariage • consanguineous • not consanguineous	 2 7	 (25%) (30%)	 2 13	 (25%) (60%)	 4 4	 (50%) (10%)	0,150
Age of the mothers (				43 +/-4	38+/-5	43+/-8	0,020
Level of study of mothers: • not in school • primary • secondary • High School • top	1 3 4 2 6	 (33%) (37,5%) (80%) (29%) (67%)	1 3 1 3 2	 (33%) (37,5%) (20%) (32%) (22%)	 1 2 0 2 1	 (33%) (25%) (0%) (29%) (11%)	0,751
Professional activity: • Present • Absent	 8 8	 (50%) (50%)	 5 5	 (31%) (31%)	 3 3	 (19%) (19%)	1,000
Time : • Full time • Partial time • Occasional	 5 2 0	 (72%) (40%) (0%)	 1 2 1	 (14%) (40%) (50%)	 1 1 1	 (14%) (20%) (50%)	0,444

Table 2: Analytical Results by Depression

The variables studied	Depression						P
	established		Likely		Absent		
Age : (average +/- standard deviation)	10 +/-2		10 + /- 3		9 + /-3		0,085
Sex • Male • Female	 7 2	 (31%) (18%)	 9 6	 (40%) (54%)	 5 3	 (29%) (27%)	0,659
Mariage • consanguineous • not consanguineous	2 7	 (25%) (30%)	 2 13	 (25%) (54%)	 4 4	 (25%) (16%)	0,150
Age of the mothers (average Standard deviation)	45 +/- 3		42 +/-2		45 + /-3		0,812
Level of study of mothers: • not in school • primary • secondary • High School • top	 0 1 1 3 4	 (0%) (12,5%) (20%) (42%) (44%)	 2 6 2 3 2	 (67%) (75%) (40%) (42%) (22%)	 1 1 2 1 3	 (33%) (12,5%) (40%) (16%) (34%)	0,484
Professional activity: • Present • Absent	 6 3	 (37%) (19%)	 6 9	 (37%) (56%)	 4 4	 (25%) (25%)	0,449
Time : • Full time • Partial time • Occasional	 3 2 0	 (42%) (40%) (0%)	 2 1 2	 (29%) (20%) (100%)	 2 2 0	 (29%) (40%) (0%)	0,355
Monthly income : • <2000 Dhs • 2000- 5000 Dhs • 5000- 10,000Dh • > 10,000 Dh	 0 1 1 0	 (0%) (16%) (25%) (0%)	 1 2 1 1	 (33%) (32%) (25%) (100%)	 2 3 2 0	 (67%) (54%) (50%) (0%)	0,595
Age of the Fathers (average Standard deviation)	50 +/- 3		52 +/-2		52 + /-3		0,810
Level of study of fathers: • not in school • primary • High School • top	 0 1 2 6	 (0%) (50%) (67%) (31%)	 1 1 0 8	 (100%) (50%) (0%) (42%)	 0 0 1 5	 (0%) (0%) (33%) (26%)	0,420
Professional activity : • Present • Absent	 9 0	 (29%) (0%)	 14 1	 (45%) (100%)	 8 0	 (25%) (0%)	0,557

Monthly income :							0,793
• <2000 Dhs	1	(100%)	0	(0%)	0	(0%)	
• 2000- 5000 Dhs	2	(20%)	6	(60%)	2	(20%)	
• 5000- 10,000Dh	2	(15%)	7	(54%)	4	(30%)	
• > 10,000 Dh	4	(50%)	2	(25%)	2	(25%)	

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