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Short Title: Biopsychosocial Evaluation in Adolescents

Psychological Burden of Asthma in Adolescents and Their Parents

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Abstract

Introduction: Asthma, a common chronic disease in adolescents is impacted by factors affecting quality of life. This study aimed to determine the psychosocial factors of adolescents with asthma and their parents.

Methods: The study included 122 adolescents with asthma, 82 healthy controls, and their parents who completed the Asthma Control Test (ACT), Pediatric Asthma Quality of Life Questionnaire (PAQLQ) and the Brief Symptom Inventory (BSI).

Results: The mean age was 14.2 ± 1.9 years. ACT score was high and depression was low in patients with good treatment compliance. As the age of the first asthma symptoms/diagnosis increased, somatization, anxiety, hostility and general psychopathology scores increased, as did the somatization score of parents. Parental anxiety score was not related with adolescent BSI scores in the controls but in the study group when it was higher, the anxiety, depression, somatization, and general psychopathology scores were higher. PAQLQ showed that anxiety, negative self-esteem, somatization, depression, and general psychopathology were higher in patients concerned about asthma. Depression and somatization scores were higher in the parents of patients who perceived that "Treatment does not contribute to asthma control." Somatization scores were higher among parents of patients who noted: "Asthma will not pass in the long-term" and "I cannot control asthma".

Conclusion: Higher scores of asthma patients who were anxious about the disease and families who were despondent about treatment demonstrate that health care providers should spend more time informing patients and caregivers. Increasing patient treatment compliance during early adolescence will lessen the psychological burden of the disease.

Keywords adolescent; asthma; parents; psychopathology

Introduction

Asthma is the most common chronic illness in adolescence with acute exacerbations. Its severity varies from very mild to disabling and/or life-threatening (1, 2). Characterized by airway obstruction, inflammation, and hyper-reactivity, asthma often results in complications, including

activity limitations, difficulty in sleeping, persistent cough, and, in some extreme cases, hospitalization or even death (3). These life-threatening conditions of asthma can affect the psychological adjustment of youth. Adolescents with asthma are twice as likely as their healthy peers to exhibit clinically significant symptoms of anxiety, with an estimated 20–40% meeting the DSM-IV-TR criteria for at least one anxiety disorder and appears an elevated prevalence of anxiety disorders among individuals with asthma, hypertension, ulcers and arthritis what may be due to reasons other than anxiety disorder directly causing the medical condition (4). Ortega et al. found a higher rate of separation anxiety disorder, overanxious disorder, and phobias among youth with asthma in comparison to those with diabetes and other chronic illnesses (5). Evidence for the link between asthma and mental health problems among adolescents is increasing, and how asthma relates to changes in depression and anxiety over time during early adolescence, a period characterized by increases in internalizing symptoms, remains unknown (6). Internalization problems, such as anxiety and depression, and externalization problems, such as aggression and confrontation, are potential concerns for children with chronic disease (7, 8). Moreover, psychopathology, family dysfunction, and medication mismatch have been associated with an increased risk of severe, poorly-controlled asthma (9). In adolescents with asthma, it can be difficult to identify the psychological symptoms and signs if they are not specifically investigated. Therefore, it is important to closely examine the relationship between psychological factors and asthma in order to understand how psychological and family variables affect or result in various manifestations.

The present study aimed to assess mental health disorders in a sample of asthmatic adolescent outpatients and their parents using a biopsychosocial approach.

Methods

This prospective, cross-sectional study was conducted between March 2016 and September 2017, at Hacettepe University Ihsan Dogramaci Children Hospital, Department of Pediatrics, Division of Allergy and Immunology and the Division of Adolescent Medicine. Approval for the study was obtained from the Hacettepe University Clinical Research Ethics Committee (registration number: GO 15/642). Written informed consent was obtained from all the adolescents and their parents.

Participants

The study group consisted of 122 adolescents diagnosed with asthma for at least 6 months of follow up (Global initiative for asthma <https://ginasthma.org/gina-reports/>) and the control group consisted of 82 healthy adolescents. The participants in the study group were questioned concerning asthma demographics, control parameters and medications at the Asthma Clinic visit. They were also evaluated with face to face interviews at the Division of Adolescent Medicine. The sexual maturity rate of the participants was determined by physical examination based on Tanner classification system (10). The psychosocial development information was obtained using a structured interview; home, education/employment, eating, activities, drugs, sexuality, suicide/depression, safety (HEEADSSS) (11), in which the questions move from less personal to confidential issues. Adolescents were divided into three groups depending on their age (according to physical, sexual, cognitive, social and emotional changes): early (10–13 years), middle (14–16 years), and late (17–21 years) adolescence. And in both group, parents' education levels were obtained.

Data collection

Asthma Characteristics

The asthma questionnaire was used to obtain the following information: (1) symptom age (years), diagnosis age (years), follow-up period in months; (2) atopy history in the family and patient; (3) number of asthma attacks and emergency room admissions, hospital admissions, and outpatient visits due to asthma in the previous year; (4) frequency of complaints in the last 12 months (wheezing, shortness of breath/chest tightness, cough without cold, night wakening, etc.); and (5) asthma-related school absenteeism in the last 12 months (completed by the patients) (12, 13). The following data were also obtained: lung function test results, percentage of eosinophils, absolute eosinophil counts, total immunoglobulin E (IgE) results, and severity of asthma (mild persistent, moderate persistent, and severe) (Global initiative for asthma <https://ginasthma.org/gina-reports/>), based on follow-up data from laboratory tests over the last 6 months, as noted by the physician.

Asthma Control Test (ACT)

In the ACT, a score of 25 points is considered to indicate very well controlled; a score of 20–24 points indicates well controlled, and a score <19 points indicates not well (poorly) controlled asthma within the last month (14).

Compliance with Asthma Treatment

Treatment compliance was determined by a specialist physician who followed the patient one-on-one, and the amount of medication each patient was actually taking was noted. Compliance was categorized as: very good, good, good enough, poor, and very poor (15).

Pediatric Asthma and Quality of Life (PAQLQ)

Adolescent self-report asthma symptoms were examined using the symptoms subscale of the PedsQL™ 3.0 Asthma Module, which is a measure of asthma-specific health-related quality of life (16).

Brief Symptom Inventory (BSI)

The BSI is an effective scale that has been shown to have reliable results in studies conducted to capture the psychiatric problems that accompany various medical conditions (17). The validity and reliability of the Turkish version of this scale was conducted by Sahin et al. (18, 19). The cut-off point for psychopathology was found as Global Severity Index (GSI) =1.0 (19).

Brief Symptom Inventory had answers by “none” to “very much” which were rated from “0” to “4”. The subjects were asked to read and answer questions alone taking the last week into consideration. The scores were grouped in 5 subsets including; “Anxiety”, “Depression”, “Negative self-esteem”, “Somatization” and “Hostility”(17). The total scores of these subsets were divided by 53 that is the number of questions and the final scores were obtained.

Statistical Analysis

Statistical analyses were performed using SPSS version 22.0 statistical software package (IBM SPSS Statistics, USA). First normality tests for continuous variables were performed and as all of the continuous variables were distributed non-normally the results were given as median [inter-quartile range(IQR)]. The chi-square and Mann-Whitney U tests were used to compare nonparametric values. Logistic regression analysis for risk assessment and Kaplan Meier analysis for change in compliance by time were used. The level of statistical significance was set at $p < 0.0$ Statistical analyses were performed using SPSS version 22.0 statistical software package (IBM SPSS Statistics, USA). First normality tests for continuous variables were performed and as all of the

continuous variables were distributed non-normally the results were given as median [inter-quartile range(IQR)]. The chi-square and Mann-Whitney U tests were used to compare nonparametric values. Logistic regression analysis for risk assessment and Kaplan Meier analysis for change in compliance by time were used. The level of statistical significance was set at $p < 0.05$

Statistical analyses were performed using SPSS version 21.0 statistical software package (IBM SPSS Statistics, USA). First normality tests for continuous variables were performed: The variables distributed normally were expressed as mean $\pm$ standard deviation and the results with the variables distributed non-normally were given as median [inter-quartile range(IQR)]. The chi-square test was used to document non parametric variables. Mann-Whitney U or Kruskal-Wallis tests were used for comparison if the variables were not normally distributed. In continuous normally distributed variables Student's t test or One-way ANOVA tests were used when appropriate. Logistic regression analysis for risk assessment was performed. The level of statistical significance was set at $p < 0.05$.

Results

The mean age was 14.1 ± 1.9 years in the study group and 14.4 ± 1.8 years in the control group ($p = 0.296$). In the study group the mean age of onset of the asthma symptoms was 5.6 ± 3.9 years, the mean age of asthma diagnosis was 8.1 ± 7.6 years, and the mean follow-up period was 74.8 ± 46.5 months. The demographic variables of the participants were shown in Table1.

The mean ACT score of adolescents with asthma was 22.6 ± 3.6 . Lung function tests revealed forced expiratory volume (FEV1) (%) as 89.7 ± 16.2 . Total IgE was 137.0 (1.28–2813.0) the eosinophil (%) was 2.5(0.1–11.2), and the absolute eosinophil count was 200.0(0.0–800.0)/ μ L. And 23.3% [$n = 27$] of fathers and 12.1% [$n = 14$] of mothers were university graduates. Totally 89 of the patients completed the BSI surveys.

Asthma Treatment Compliance

Two groups (good and poor) were defined depending on the treatment compliance. A total of 79.2% [$n = 84$] of the patients with asthma had good (good + good enough + very good) treatment compliance, and 20.8% [$n = 22$] had poor (poor + very poor) treatment compliance. The mean age (13.7 ± 1.8 years) of the patients with good treatment compliance was lower than the mean age (15.1 ± 1.5 years) of the patients with poor compliance ($p = 0.002$). Good treatment compliance was higher in early [$(n = 31, (36.9\%))$] and middle [$(n = 31, (36.9\%))$] adolescence than late [$(n = 22, (26.2\%))$] adolescence ($p = 0.001$). Tanner stages and treatment compliance were not correlated significantly in both male ($p = 0.137$) and female ($p = 0.111$) adolescents. Treatment compliance did not differ according to disease severity [mild (78.5%) or severe (78.3%), $p = 0.982$]. Adolescents with good or poor treatment compliances had similar scores of BSI for anxiety ($p = 0.756$), negative self-esteem ($p = 0.740$), somatization ($p = 0.860$), hostility ($p = 0.639$) and general psychopathology ($p = 0.756$) but the rate of depression scores were higher in patients with poor compared to those with good treatment compliance [88.9% vs 68.2%, ($p = 0.030$)].

ACT

For the ACT, 52.3% [$n = 58$] of the adolescents with asthma indicated that their asthma was very well-controlled, 30.6% [$n = 34$] indicated that their asthma was well-controlled, and 17.1% [$n = 19$], indicated that their asthma was poorly controlled. The ACT and PAQLQ results are shown in **Table 2**. The ACT scores did not differ in patients who were in different periods of adolescence [early, middle and late adolescence, ($p = 0.522$)], and with regards to gender ($p = 0.206$), Tanner stages in both females ($p = 0.504$) and males ($p = 0.074$), and parents' education levels ($p > 0.05$).

The patients with good treatment compliance were higher in very well-controlled group (57.3%, $n = 47$) and well-controlled (34.1%, $n = 28$) when compared with the poorly controlled group (8.5%, $n = 7$) ($p = 0.001$).

Asthma Quality of Life

The mean age was 13.8 ± 1.8 years in the thought of treatment contributed to asthma control and the age was 14.7 ± 1.8 years with negative thought about it ($p = 0.034$). The opinion of favorable contribution of treatment to asthma control was shared more by patients with a family history of atopy compared to those without a family history of atopy ($p = 0.002$). Moreover, 45.8% [$n = 11$] of the patients with moderate-to-severe asthma and 21.0% [$n = 17$] of the patients with mild asthma indicated that they were worried about asthma ($p = 0.016$). Of the asthmatic patients those were worried about asthma, reported higher levels of anxiety ($p = 0.042$), and negative self-esteem ($p < 0.001$), somatization ($p = 0.003$), general psychopathology ($p = 0.006$), and depression ($p < 0.001$) compared to asthmatic patients who were not worried about asthma. In asthmatic patients with negative self-esteem, the rate of opinion “I do not know asthma” was higher [(72.2% vs 27.7%, ($p = 0.021$)). Somatization scores were lower in patients who thought “I can control asthma” compared to patients who disagreed this opinion [(34.7% vs 65.3%, ($p = 0.019$)). The rate of somatization in girls (31.9% [$n = 23$]) was higher than in boys (18.2% [$n = 18$]), and it was found that female gender increased risk of somatization [OR = 1.757, (95% CI = 1.027–3.006)]. Depression (31.8% in group of “treatment has no effect on my asthma” vs 12.0% in group of “treatment has an effect on my asthma”, $p = 0.044$) and somatization (35.3% “in group of “treatment no has no effect on my asthma” vs 12.7% in group of “treatment has an effect on my asthma”, $p = 0.034$) in the parents of those who thought that treatment would not contribute to asthma control were higher. Somatization was higher in the parents of the adolescents with asthma who thought that asthma would not pass in the long-term compared the ones who had an opposite opinion (70.6% vs 36.4%, $p = 0.013$). No differences were found between groups (study and control) concerning anxiety, depression, negative self-esteem, somatization and hostility of BSI indexes ($p > 0.05$).

The BSI results of eighty-nine cases in the patient and eighty-two cases in control group are presented in **Table 3**. GSI scores were above cut-off in 19.1% of asthmatic adolescents compared to healthy controls (35.4%, $p = 0.017$). The scores of depression (36.0% in parents of study vs 21.6% in parents of control, $p = 0.046$) and somatization (27.9% in parents of study vs 13.3% in parents of control, $p = 0.024$) were higher in parents of the study group when compared to the parents of the control group.

The mean age of diagnosis of asthma in patients with somatization was 9.6 ± 4.1 years and significantly older than the patients without somatization (7.2 ± 3.5 years, $p = 0.019$). The mean age of the onset of asthma symptoms in patients with anxiety was 8.5 ± 3.7 years and significantly older than the patients without anxiety (5.5 ± 3.7 years, $p = 0.007$). Patients with hostility had a mean onset of asthma symptom age of 7.2 ± 4.0 years and was significantly older than the patients without hostility (5.3 ± 3.7 years, $p = 0.039$). The mean age of onset of asthma symptoms was 7.9 ± 4.3 years in adolescence with general psychopathology and significantly older than those without general psychopathology (5.6 ± 3.7 years, $p = 0.043$). The parental anxiety was found to be higher for 38.7% of the patients whose mothers had a higher education level (high school-university) than those whose mothers had a low educational level (12.0%) ($p = 0.005$). But there was no significant difference in education levels of fathers and BSI outcomes ($p > 0.05$).

Depression score was lower in adolescents with good treatment compliance than those with poor treatment compliance [OR = 0.268, (95% CI 0.078–0.921), $p = 0.030$]. While parental anxiety did not affect the BSI scores in the control group, with the presence of parental anxiety in adolescents with asthma, anxiety [OR = 3.904, (95% CI 1.200–12.695), $p = 0.018$], depression [(OR

= 3.125, (95% CI 1.103–8.857), $p = 0.028$); somatization [OR = 3.000, (95% CI 1.007–8.937), $p = 0.043$]; and general psychopathology [OR = 3.410, (95% CI 1.072–10.845), $p = 0.031$] of adolescents were found higher. The parental negative self-esteem increased somatization [OR = 3.410, (95% CI 1.072–10.845), $p = 0.031$] and general psychopathology [OR = 3.600, (95% CI 1.070–12.115), $p = 0.031$] in the study group. Anxiety [OR = 3.929, (95% CI 1.235–12.496), $p = 0.016$], negative self-esteem [OR = 2.944, (95% CI 0.976–8.884), $p = 0.049$], somatization [OR = 4.983, (95% CI 1.710–14.521), $p = 0.002$], and general psychopathology [OR = 3.375, (95% CI 1.093–10.423), $p = 0.029$] increased somatization in the study group. The overall psychopathology in the parents was found to increase anxiety in both groups [OR = 3.365, (95% CI 1.069–10.592), $p = 0.032$] and [OR = 4.381, (95% CI 1.299–14.778), $p = 0.013$]. The results of the univariate and multivariate regression analyses, with some of the variables that may affect somatization in the study group, are presented in **Table 4**.

Discussion

Treatment compliance in asthma therapy is essential for maximum efficacy (20) and is reported to be especially low during adolescence (21). In this study, adolescents with asthma with better treatment compliance had higher quality of life and lower psychopathology. Also, treatment compliance was found higher in early and middle adolescence than the late while not differing with the age at diagnosis of asthma, onset of symptoms or the severity of asthma which suggests biological maturation has an impact on asthma treatment during adolescence.

A contributing factor to poor treatment compliance has been defined to be poor asthma control (22) and better asthma control was reported to be directly related to a better quality of life and less impairment in emotional changes (23). In our study, the adolescents with asthma who self-reported to be emotionally affected by and worried about the disease mainly had poor asthma control whereas asthma control was found better with good treatment compliance. Also, the patients with very well-controlled asthma expressed that it did not affect their lives. These results indicate the need to increase treatment compliance and ensure persistence of compliance in adolescents with asthma. Improving treatment compliance in late adolescence seems to be much more challenging, if this opportunity is missed in early and middle adolescence. If the adolescents can develop healthy coping strategies and resilience to chronic illness earlier in adolescence, adolescents can begin to perceive their illness as a natural part of their lives and include it in their personality patterns in late adolescence. The knowledge of the health care providers, and caretakers about this specific period of life is important because there is a linear disease burden with both very authoritarian or helicopter families which may cause maladaptation of the adolescent. Giving gradual responsibility to adolescent improving self-esteem and increasing treatment compliance is essential.

The patient related factors reported to have an impact on asthma control are having psychiatric comorbidity (anxiety, depression), smoking, inadequate information about the treatment (24). An important result of this study is that early diagnosis reduces the risk of asthma-related somatization, anxiety, hostility, and general psychopathology. Early diagnosis and regular follow up of asthma also facilitates better psychological adjustment to the disease and its chronic course (25). We also found that the severity of asthma increased internalizing problems in adolescents such as anxiety, depression, negative self-esteem, and somatization and the general psychopathology. However, negative self-esteem in adolescents who believe they know how to control asthma decreased, as did the somatization, depression, as well as somatization in their parents. The higher the education level of the mother, the higher the anxiety was observed as reported in the literature (26, 27). Parental anxiety increased anxiety, depression, somatization, and general psychopathology in adolescents with asthma while not affecting psychopathology in the control group which suggests different reflection levels. However, the treatment team has also utmost importance. Treatment compliance in adolescents can be enhanced by a collaboration between adolescent medicine and

allergy-immunology clinics with regular visits and should be characterized by discussing the therapeutic options with and giving gradual responsibility to the adolescent. Clinicians also should keep in mind that cognitive development may not always run parallel to biological and psychosocial development in adolescents. One-on-one motivational interviews with adolescent patients should be conducted and then a constructive, parallel relationship can be established with the parents.

Limitation

The total number of participants in the study group was 122 but only 89 of them completed all of the assessment tools including BSI. A majority of the patients who did not fill in the forms were those travelling to our clinic from out of town. Although this was the main limitation of the study we had a sufficient number of cases in each group to compare statistically.

Conclusion

The higher psychiatric symptoms of the adolescents with asthma who were anxious about the disease and the families who were despondent about the treatment demonstrate that health care providers need to spend more time informing and assuring adolescent patients and caregivers. Increasing patient treatment compliance during early adolescence will lessen the psychological burden of the disease. The impact of parental psychiatric symptoms on psychological well-being and disease-related thoughts of adolescents should be considered. Because the physical, cognitive, and psychosocial development of adolescents may vary, a bio-psycho-social approach should be adopted in the follow-up of patients with asthma.

Disclosure of interest

The authors report no conflict of interest.

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Table 1. Demographic characteristics of the adolescents in the study and control groups.

Variables	Study Group (mean±SD)	Control Group (mean±SD)	Total (mean±SD)	p
Age (yrs.)	14.1 ± 1.9	14.4 ± 1.8	14.2 ± 1.9	0.296
Weight (kg)	58.5 ± 14.2	57.6 ± 16.4	58.1 ± 15.1	0.673
Height (cm)	162.3 ± 10.3	163.1 ± 15.0	162.7 ± 12.5	0.685
BMI (kg/m ²)	22.0 ± 4.2	21.2 ± 3.7	21.7 ± 4.0	0.180
Gender	% (n)	% (n)	% (n)	
Male	59.8% (n = 73)	40.2% (n = 49)	59.8% (n = 122)	0.991
Adolescence stages				
Early	72.5% (n = 37)	27.5% (n = 14)	27.0% (n = 51)	
Middle	63.1% (n = 41)	36.9% (n = 24)	34.3% (n = 65)	0.355
Late	60.3% (n = 44)	39.7% (n = 29)	38.6% (n = 73)	
Tanner Male				
Stage2	58.7% (n = 27)	41.3% (n = 19)	37.3% (n = 46)	
Stage3	54.5% (n = 18)	45.4% (n = 15)	27.0% (n = 33)	0.635
Stage4	65.1% (n = 28)	34.9% (n = 15)	35.2% (n = 43)	
Tanner Female				
Stage2	62.5% (n = 10)	37.5% (n = 6)	19.5% (n = 16)	
Stage3	69.6% (n = 16)	30.4% (n = 7)	28.0% (n = 23)	0.433
Stage4	53.5% (n = 23)	46.5% (n = 20)	52.4% (n = 43)	

Table 2. Association between Asthma quality of life and ACT scores.

Asthma quality of life questions	ACT Scores						
	Very well-controlled (n = 58)		Well-controlled (n = 34)		Poorly-controlled (n = 19)		P
	n	%	N	%	N	%	
Asthma does not affect my life	39	68.4	22	64.7	7	36.8	0.010
Asthma will not pass	16	27.5	14	41.1	13	68.4	0.016
I can't control asthma	15	39.4	11	32.3	13	68.4	0.009
Treatment does not contribute to asthma control	5	8.6	5	14.7	10	52.6	<0.001
I'm worried about asthma	6	10.3	9	26.4	11	57.8	<0.001
I don't know about asthma	28	48.3	18	52.9	7	36.8	0.361
Asthma affects me emotionally	5	9.6	8	25.0	8	42.1	0.008

Table 3. BSI scores above the cut-off levels in the study and control groups.

BSI	Study group		Control group		Total		
	(n = 89)		(n = 82)				
Adolescents	N	%	N	%	N	%	P
Anxiety	17	19.1	23	28.0	40	23.4	0.167
Depression	27	30.3	26	31.7	53	31.0	0.847
Negative self-esteem	18	20.2	21	25.6	39	22.8	0.402
Somatization	23	25.8	18	22.0	41	24.0	0.552
Hostility	32	36.0	33	40.2	65	38.0	0.564
GSI	17	19.1	29	35.4	46	26.9	0.017*
Parents							
Anxiety	20	23.3	9	12.2	29	18.1	0.069
Depression	31	36.0	16	21.6	47	29.4	0.046*
Negative self-esteem	16	18.6	15	20.3	31	19.4	0.790
Somatization	24	27.9	10	13.3	34	21.1	0.024*
Hostility	28	32.6	23	31.1	51	31.9	0.842
GSI	26	30.2	14	18.9	40	25.0	0.099

Table 4. Somatization univariate analysis in the study group.

Variables	Univariate			Multivariate			
	OR	95% CI	P	Variables	OR	95%CI	p
Gender (1)	4.273	1.537-11.879	0.005	Gender	1.525	0.061-0.783	0.020
Tanner stage (breast)	1.365	0.577-3.227	0.479				
Tanner stage (pubic hair-male)	2.000	0.647-6.188	0.229				
Age	1.145	0.891-1.472	0.291				
Asthma symptom age <7	2.979	1.037-8.563	0.043	Asthma severity	1.546	1.167-18.881	0.029
Asthma diagnosis age <7	2.889	0.959-8.702	0.059	Asthma diagnosis age <7	0.898	0.711-8.472	0.155
ACT score	0.847	0.726-0.987	0.033	Asthma control	-0.324	0.135-3.875	0.705
Atopy +/-	0.366	0.132-1.011	0.052				
Parental anxiety	3.000	1.007-8.937	0.049				
Parental negative self-image	3.410	1.072-10.845	0.038				
Parental somatization	4.983	1.710-14.521	0.003				
I can't control asthma	0.284	0.097-0.834	0.022				
I'm worried about asthma	5.512	1.710-17.766	0.004				
Asthma affects me emotionally	6.067	1.640-22.441	0.007				

Gender*=female according to male (1).