EPIDEMIOLOGICAL EVALUATION OF MALARIA IN THE PERI-MILLENNIAL DECADE (1995-2004) IN ADANA, ÇUKUROVA REGION, TURKEY

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ABSTRACT

• ***Objective:*** *Malaria is still an important public health problem with more than 300 millions of cases and almost two millions of deaths annually. Despite a sustain ed decrease, malaria is still prominent in Stratum-I and Adana, Turkey, due to the population density, the high rate of immigration/emigration. This study aimed to determine the status and changes of malaria characteristics in Adana province in terms of inter- and intra-annual frequencies, properties of the infected cases in the peri-millennium (1995 to 2004), and the affecting factors*

• ***Material and Method:*** *This retrospective study was carried out by screening the registry of Adana Center for Malaria Fight.The diagnosis of malaria had been established at primary health care level by experienced malaria workers and confirmed by a parasitologist using blood samples from patients detected by active or passive surveillance between 1995 and 2004.*

• ***Results:*** *A total of 12,658 cases of malaria were detected. There were found decreases of frequencies of 99.5% in Adana, 93.5% in Stratum-I and 93.5% in Turkey. The changes in frequency rates and interactions between them were analyzed and discussed in the light of factors like environment, management/economics, population movements and anti-malarial activities.*

The malaria positivity rate among feverish patients had decreased, the disease had shifted to rural character and to older ages, and its seasonal pattern had shifted.

• ***Conclusion:*** *The situation of malaria changed due to population movement changes and the effect of antimalarial activities, and with cooperation between different entities and sectors, in addition to early diagnosis and treatment.*

• ***Key Words:*** *Malaria, epidemiology, primary health care, risk factors, developing countries.* ***Nobel Med 2009; 5 (Suppl 1): 56-62***

ÖZET

MİLENYUMA GİRERKEN (1995-2004 YILLARI ARASINDA) ÇUKUROVA BÖLGESİ-ADANA'DA SITMANIN EPİDEMİYOLOJİK DEĞERLENDİRİLMESİ

• **Amaç:** Yılda 300 milyondan fazla vaka ve iki milyon civarında ölüme neden olan sıtma hala dünyada önde gelen halk sağlığı sorunlarından birisidir. Sıtma sıklığı sürekli bir azalma göstermişse de nüfus yoğunluğu, içe/dışa göçlerin fazlalığı nedeniyle Stratum-I ve Adana'da hala dikkati çekmektedir. Bu çalışmada yıl içi ve yıllar arası sıklık, enfekte vakaların özellikleri gibi değişkenler açısından peri-milenyumda (1995 ile 2004 arası) sıtmanın Adana'daki durumu ve değişimi ile etkili olan faktörlerin belirlenmesi amaçlandı.

• **Materyal ve Metod:** Bu retrospektif çalışmada Adana Sıtma Savaş Merkezi kayıtları tarandı. Sıtma tanısı, birinci basamakta, deneyimli sıtma çalışanları tarafından, 1995 ve 2004 yılları arasında aktif veya pasif sürveyansla saptanan hastalardan alınan kan örnekleri aracılığı ile konmuş ve bir parazitolog tarafından doğrulanmıştı.

• **Bulgular:** Bu dönemde toplam 12.658 sıtma vakası saptanırken, sıtma sıklığının Adana'da %99,5, Stratum-I'de %93,5 ve Türkiye'de %93,5 azaldığı görüldü. Sıtma sıklığındaki değişimler ve aralarındaki etkileşim çevresel, yönetimsel/ekonomik, nüfus hareketleri ve anti-malaryal aktiviteler ışığında analiz edilip tartışıldı.

Ateşli hastalarda sıtma pozitifliğinin azaldığı, sıtmanın kırsal karaktere döndüğü, daha ileri yaş gruplarında görüldüğü ve mevsimsel karakterinin değiştiği görüldü

• **Sonuç:** Sıtmanın durumu nüfus hareketleri ve anti-malaryal aktivitelerin etkisi ile değişmişti. Bunda birimler ve sektörler arası işbirliği ile birlikte erken tanı ve tedavinin de etkisi olmuştu.

• **Anahtar Kelimeler:** Sıtma, epidemiyoloji, birinci basamak hekimliği, risk faktörleri, gelişmekte olan ülkeler. **Nobel Med 2009; 5 (Suppl 1): 56-62**

INTRODUCTION

Malaria, which destroyed several ancient civilizations in the history, is a life-threatening disease that presents with pyrexia, chill shaking and sweating. It is spread by mosquitoes.[1,2] Malaria, with more than 300 millions of acute illnesses and almost two millions of deaths annually -half of these observed among young children- in the peri-millennial decade[3], still occupies an important place in the disease burden in the world, especially in the tropical and sub-tropical regions of the world, with 247 million malaria cases among 3.3 billion people at risk in 2006, causing nearly a million deaths, mostly of children under 5 years, 109 countries being endemic for malaria in 2008.[4-6] Hence malaria has been included in the list of Millennium Development Goals as "Target 6" aiming to have halted and begun to reverse the incidence of the disease by 2015.[7,8]

Neither the malaria eradication program initiated in 1950 by the World Health Organization (WHO), nor the insecticides could prevent the disease to survive up-to-day. In Turkey, while the initiation of a similar anti-malarial fight program in 1926[1], the introduction of dicloro-diphenyl-tricloretane (DDT) against vectors in 1948 and the adoption of WHO guidelines in 1957 could decrease the disease frequency to as low as 1263 by the end of 1970, the year 1977 witnessed a tremendous epidemic in Cukurova region (plain area located in the south along the Mediterranean coast of Turkey) with 115,512 cases due to the decrease in both financial and personnel support. The re-engagement of a serious anti-malarial policy could decrease the malaria incidence to 8,680 cases in 1990, but could not prevent the last 1994 epidemic with 84,345 cases in south-eastern Anatolia as reported by the Turkish Ministry of Health.[1,9] Although the disease followed a sustained decrease in Turkey, Stratum I region, with the highest malaria frequency in Turkey, is also the source of infection for all the rest of the country, hence the status of malaria in this region has an outstanding importance. The changes in the characteristics of malaria in the region reflect not only the success of anti-malarial fight in the country, but also the effect of environmental or similar factors.

There is a lack of studies evaluating the characteristics of the disease in Adana province, which has the highest population in Cukurova region located in Stratum I, and which is also prominent for immigration or emigration as the region is the agricultural locomotive in the country, is the location with highest transmission rate in this stratum.[1]

Hence we aimed to determine the status and changes of malaria characteristics in Adana province in terms of inter- and intra-annual frequency distribution, properties of infected cases, like age, gender, location (urban versus rural), fever presence, comprising a period of 10 years between 1995 and 2004, i.e. in a peri-millennial context, and the effect of environmental, economic or managerial factors on the course of the disease. →

MATERIAL and METHOD

This retrospective study was carried out comprising a period between the years 1995 and 2004, by screening the registry of The Center for Malaria Fight (CMF) in Adana province, which is the main location of the Cukurova region in the southern part of Turkey along the Mediterranean coast.

Table 1: Interannual distribution of malaria cases in Adana province, stratum-I and Turkey between 1995 and 2004*

Years	Frequencies in Adana province	Frequencies in stratum-I	Frequencies in Turkey (Whole country)	Proportion of frequencies in Adana to those in stratum-I (%)	Proportion of frequencies in stratum-I to those in Turkey (%)
1995	5,052	78,378	6.45	82,096	95.47
1996	3,459	57,464	6.02	60,884	94.38
1997	2,064	33,744	6.12	35,456	95.17
1998	969	35,094	2.76	36,842	95.26
1999	478	18,990	2.52	20,963	90.59
2000	176	10,513	1.67	11,432	91.96
2001	258	10,318	2.50	10,812	95.43
2002	133	9,839	1.35	10,224	96.23
2003	44	8,917	0.49	9,222	96.69
2004	25	5,088	0.49	5,302	95.96

*Values in bold were intended to emphasize the main discussion points in the text. Chi-square trend=2177.1, p<0.0001

Table 2: Distribution of malaria cases in Adana according to age groups between 1995 and 2004

	Age groups					
Years	0 years old (%)	1-4 years old (%)	5-14 years old (%)	Subtotal 0-14 years old (%)**	≥15 years old (%)**	Total
1995	10 (0.2)	236 (4.7)	1,282 (25.4)	1,528 (30.3)	3,524 (69.7)	5,052
1996	20 (0.6)	142 (4.1)	786 (22.7)	948 (27.4)	2,511 (72.6)	3,459
1997	3 (0.1)	77 (3.7)	459 (22.3)	539 (26.1)	1,525 (73.9)	2,064
1998	2 (0.2)	44 (4.5)	211 (21.8)	257 (26.5)	712 (73.5)	969
1999	1 (0.2)	19 (4.0)	102 (21.3)	122 (25.5)	356 (74.5)	478
2000	1 (0.5)	9 (5.1)	33 (18.8)	43 (24.4)	133 (75.6)	176
2001	0 (0.0)	6 (2.3)	63 (24.4)	69 (26.7)	189 (73.3)	258
2002	0 (0.0)	6 (4.5)	23 (17.3)	29 (21.8)	104 (78.2)	133
2003	0 (0.0)	0 (0.0)	7 (15.9)	7 (15.9)	37 (84.1)	44
2004	0 (0.0)	1 (4.0)	4 (16.0)	5 (20.0)	20 (80.0)	25
Total (%)	37 (0.3)	540 (4.3)	2,970 (23.5)	3,547 (28.1)	9,111 (71.9)	12,658

*Values in parentheses are row percentages
** The columns compared with chi-square test (i.e. 0-14 years versus ≥15 years) Chi-square=27.21, d.f.=9, p<0.005

The diagnosis of malaria was established at primary health care level by experienced malaria workers, examining, the thick blood smears of peripheral blood stained with 10% Giemsa dye under the light microscope, which is accepted as the gold standard test in malaria, from patients detected by active or passive surveillance. The samples were confirmed by a parasitologist at the laboratory. Among the terms used in the location comparisons, "urban" comprised cases detected in the city center, while "rural" comprised those living in the regions with intensive and active agriculture and in the settlings where seasonal migrant farm workers are accommodated.

The statistical analyses of the study were performed using chi-square test and trend analysis. Two-tailed statistical significance was reported when the calculated p value was less than 0.05.

RESULTS

The total number of malaria cases was found as 12.658 comprising the period of 10 years with male to female ratio of 6709 (53.0%) to 5949 (47.0%). The malaria cases were found to present a decrease in frequency of 99.5% in Adana province, 93.5% in Stratum-I region of Turkey and 93.5% in the whole of Turkey (Table1) The detailed examination of the decrease in frequency revealed that the number of malaria cases followed a stable and significant ($p<0.0001$), decreasing pattern compared to each previous year, except the year 2001 for Adana province and the year 1998 for both Stratum-I and Turkey; these years cited being presented with the reverse, i.e. the case frequencies observed in Adana province in 2001 and those in Stratum-I and in the whole country in 1998 were found to be higher than those in 2000 and 1997, respectively (Table 1). When the proportions of the case frequencies in Stratum-I to that in Turkey were examined, it was observed that the proportions calculated about 95% showed a sudden and statistically significant decrease to about 90% between the years 1999 and 2000, but rising again to the previous values starting from 2001 ($p<0.01$) (Table 1).

The same examination performed for the change of proportions of number of cases in Adana to that of cases in Stratum-I showed that a similar sharp decrease from about 6% to about 2% was observed between the years 1998 and 2002, with a temporary peak to 2.5% in 2001, when the frequency in Adana raised to 258 from 176, but resuming its decreasing pattern thereafter (Table 1).

When the distribution of cases were examined according to age groups, infant age group presenting with percentages up to 0.6% until the beginning of the millennium was found to disappear at the case count lists after the year 2000. When the percentages of cases younger than 15 years of age were compared to those of 15 years old or older, it was found that the rate of older aged cases showed an increase starting in 1996 in comparison to 1995, but it remained constant (with→

a mean of 76.3±3.7%) between 1996 and 2004 (χ^2=6.81, d.f.=8, p=0.557). It was also notable that there was found to be a transient rise in younger age group, except the infants in 2001, when the decreasing trend was interrupted with a rise of about 2% (Table 2).

The malaria positivity rate among patients with fever at primary health care level, which was 24.28 per thousand in 1995, decreased continuously to 0.27 per thousand in 2004. The only exemption was the temporary rise to 1.77 per thousand from 1.04 per thousand observed in 2001 (p<0.05) (Table 3).

Another change in the characteristics of malaria was found in the locality where the cases lived. While the cases were more frequently observed in the city center in 1995, with 32.9 per thousand of thick film smears resulting positive for malaria, this frequency showed a consistent decrease reaching a value of 0.9 per thousand in samples processed in 2004. The character of malaria significantly changed also from "urban" to "rural" starting from 1997 (p<0.05 or p<0.001) (Table 4).

When the seasonal distribution of malaria cases was examined in a manner comprising the whole peri-millennial decade, it was found that the case frequencies which decreased starting from the autumn (16.8%) through the winter (3.7%) showed an upward trend starting in the spring (23.0%) reaching a peak value in the summer (56.5%). But this expected pattern was found to change shifting towards the spring starting from 1999 and finishing with a peak in the autumn of 2001. The peaking season was observed as the summer from 2002 on, the second ranking continuing to be occupied by the autumns throughout 2002 and 2003. The expected summer-spring-autumn-winter ranking order pattern was re-established in 2004 (Table 5) (Figure).

Table 3: Distribution of malaria positivity in patients with fever in Adana between 1995 and 2004

Years	MP patients count*	FP patients count**	MP/FP rate*** (per thousand)
1995	5.052	209.210	24.28
1996	3.459	215.917	16.02
1997	2.064	144.839	14.25
1998	969	140.192	6.91
1999	478	147.401	3.24
2000	176	169.509	1.04
2001	258	145.498	1.77
2002	133	127.688	1.04
2003	44	120.114	0.37
2004	25	93.476	0.27
Total	12.658	1.513.844	8.37

*MP: Malaria positive, **FP: Fever positive
MP/FP rate: rate of malaria positivity among patients with fever

Table 4: Missed opportunities for obesity screening and management in outpatient clinics.

Years	Residence characteristics	Number of thick smears	Number of malaria positive smears	Smear positivity rate (per thousand)
1995**	City center	61.377	2.020	32.9
	Rural	147.833	3.032	20.5
1996*	City center	86.322	1.453	16.8
	Rural	129.595	2.006	12.2
1997**	City center	79.107	723	15.5
	Rural	65.732	1.341	20.4
1998**	City center	95.608	310	3.2
	Rural	44.584	659	14.8
1999**	City center	106.854	138	1.3
	Rural	40.547	339	8.4
2000**	City center	118.637	44	0.4
	Rural	50.872	132	2.6
2001**	City center	99.703	55	0.6
	Rural	45.795	203	4.4
2002*	City center	93.012	20	0.2
	Rural	34.656	113	3.3
2003**	City center	87.308	4	0.04
	Rural	32.806	40	1.2
2004*	City center	71.232	4	0.06
	Rural	22.444	21	0.9

*p<0.05 **p<0.001

DISCUSSION

Cukurova region (Cukurova Plain) located on the Mediterranean coast in the southern part of Turkey is the agricultural locomotive of the country with its 675,000 hectares wide farm fields. Adana province with a population of about 1.9 millions is the largest and the most populated province of this region. The major landholders of the region employ seasonal labor.

Every year thousands of families from south-eastern Turkey come to Adana in the spring and summer seasons as migrant farm workers. Cukurova region constitutes a suitable environment for vectors due to the high humidity and temperature as well as due to water based agriculture. Hence both Cukurova region and south-eastern region of Turkey with the highest malarial frequency are classified in the context of Stratum-I among the four geographical strata regions in Turkey. Malaria is endemically seen only in Stratum-I region, while it occurs infrequently in other strata, i.e. II, III and IV.[1]

The malaria cases were found to present a stable and significant decrease in frequency of 99.5% in Adana province, 93.5% in Stratum-I region of Turkey and→

Table 5: Seasonal distribution of malaria cases between 1995 and 2004 in Adana

Years	Spring		Summer		Autumn		Winter		Total
1995	980	19.4	3.191	63.2	723	14.3	158	3.1	5.052
1996	933	27.0	1.820	52.6	572	16.5	134	3.9	3.459
1997	506	24.5	1.090	52.8	380	18.4	88	4.3	2.064
1998	189	19.5	626	64.6	112	11.6	42	4.3	969
1999	202	42.3	202	42.3	58	12.1	16	3.3	478
2000	75	42.6	45	25.6	36	20.5	20	11.4	176
2001	6	2.3	60	23.3	188	72.9	4	1.6	258
2002	4	3.0	88	66.2	38	28.6	3	2.3	133
2003	8	18.2	25	56.8	10	22.7	1	2.3	44
2004	8	32.0	9	36.0	5	20.0	3	12.0	25
Total	2.911	23.0	7.156	56.5	2,122	16.8	469	3.7	12.658

*Values in parentheses are row percentages X^2=990.78, d.f.=27, p<0.0001

93.5% in the whole of Turkey (Table 1). This very high decrease of nearly 100% observed in Adana can be explained by the implementation of a rational anti-malarial policy including diminishing in rice planting areas, drying of breeding places of vectors, use of permanent insecticides in houses or tents, and early diagnosis and treatment of patients. In Adana, every year more than 70 thousands of houses are subject to indoor insecticide applications, in addition to larvacide use, starting from spring months, in accordance to WHO policies, where a higher intensity of vectors is expected.[4] The studies conducted show that early diagnosis and treatment, vector control, early determination of epidemics and cooperation between sectors are important factors in the control of this disease.[1, 10, 11] The result is the observed decrease of frequency of malaria in the region. Another factor in favor of this decrease is the increased rate of access to health services presenting both active and passive surveillance, accompanied by the support of laboratories and staff specialized in anti-malarial fight in primary health centers of the region, with a resulting increased rate of early diagnosis and treatment of the cases. All these helped to break the infection chain preventing the transmission to more people.

The Stratum-I is the region with the highest frequency and transmission rate of malaria in Turkey. The explanation of the overall decrease in the Stratum-I is referred to the decrease occurring in Adana, which is the largest and the most populated province in Stratum-I. Again any change observed in the Stratum-I is expected to be readily reflected in the whole country profile. But an exemption to decrease of malaria frequency was observed in 2001 for Adana province (a reverse situation, i.e. an increase of frequency calculated as 46.6%) and in 1998 for both Stratum-I and the whole Turkey (an increase calculated about 4.0%), with frequencies being increased in the mentioned years in comparison to the preceding years. In Turkey a large-scale irrigation project in the south-east of the country was established and named "South-eastern Anatolian Project (SEAP)", aiming to bring under irrigation 1.7 million hectares of land. This was reported as a great threat in the fight against malaria.[12] The consequences of this ecologic intervention started to be observed in Stratum-I starting in 1998 and with parallel reflections on the whole country's malarial frequency. As the proportion of Adana cases to that of the Stratum-I had lowered, it could be deducted that the main factors belonged to eastern part of the Stratum-I, more precisely south-eastern Anatolia with its changing ecosystem favoring the transmission of malaria in the region. The population living in the mentioned area presents with low socio-economic conditions and is a source of migrant farm workers for both the region itself and the neighboring localities like Cukurova region and Adana province. New areas of agriculture -especially watery agriculture-established following the implementation of SEAP decreased the emigration of migrant farm workers to western parts of Stratum-I.

This gave rise to a decrease of proportion of malaria cases in Adana (Cukurova Region), which was observed as changing from about 6% to about 2.5% and later towards below 0.5% (Table 1). In the preceding studies, it was demonstrated that factors like low educational levels and low income among people living in endemic regions [13, 14] socio-cultural and behavioral factors [15], increasing population, inadequate hygienic conditions, seasonal workers and internal immigration [16] had increased the risk of malaria. But it did not take long to take under control these unfavorable conditions, enhancing the fight policy against malaria in the region and the result of this extraemphasis was observed in the following years with 5% of lowering in the proportions of Stratum-I to Turkey frequencies. (Table 1).

The south-eastern part of the Stratum-I has another risk implementation which is its highest population growth rate observed in Turkey.[12] When this was added to ecological changes caused by SEAP the Stratum-I returned to its initial role of malarial origin in Turkey reaching similar proportion as about 95%. But this rise was also a consequence of economic crisis experienced in 2001, forcing migrant workers to move from east to west of the Stratum-I, i.e. Adana (Cukurova Region) and giving rise to the 2001 peak in Adana, the local character of the event being verified by the sharp peak from 1.67% to 2.50%. The situation observed can be described as a "ping-pong effect"; i.e. while the case frequencies are relatively higher ineastern part of a stratum in one period of time, they are expected to increase in the western part of the region in the following period of time.[1]→

The 2001 peak can also be explained by another factor: the age proportions of the cases (Table 2). If the percentage of younger cases -especially of infant age group- is higher than that of the adult cases, the disease is interpreted as "local", instead of being imported.[1] The observation of malaria in infants is considered as the definite evidence of domestic infection. Since the observation of malaria in infants who do not travel outside the region and who do not receive the infection from their mothers through placental way, may only be possible if the parasite was received in the current year. But further evaluation of cases demonstrated that, while the peak seemed to be confined to the age group less than 15 years of age, it was observed that the infant age group was excluded. Hence the peak of 2001 in Adana was considered as the verification of the transient implication of cases with imported character. After discussing the transient frequency changes -both positive and negative-, the overall picture revealed that the malaria load decreased in the whole country and in the subgroups. This is an indicator of successful anti-malarial efforts including the fight against vectors, starting in the early spring-time and sustained throughout the summer-time, including permanent indoor insecticide applications, in accompany with surveillance activities that allow the early diagnosis and treatment of the disease, and supported by the decrease in the rates of malaria in SEAP region. The cooperation of health professionals employed in environmental health with other related sectors played a notable role as expected.[10, 17]

A more detailed analysis of age distribution of malaria revealed that the frequency of the disease in infants had showed a sharp decrease in 1997 and no infant case was observed after the year 2001. In a broader sense, the percentages of cases younger than 15 years were found to present a constantly decreasing trend in comparison to older age groups. In other words, the age groups affected by malaria in Adana shifted from young to adult in the course of ten years (Table 2) The age distribution of malaria cases in Adana was found similar to that of other cities in Turkey and this finding was supported by other studies conducted before.[1]

In places endemic for malaria, cases with fever applying to health institutions are readily suspected for diagnosis of malaria and undergo further laboratory evaluation for exclusion of malaria. Hence the presence of fever is always evaluated for a clue to malaria diagnosis. But with the decrease of malaria frequency in Adana, the proportion of malaria cases among cases with fever applying to primary health centers was also found to decrease throughout the ten years evaluated.[6] As expected, the transient rise in frequency of malaria observed in Adana in 2001 was verified by the transient

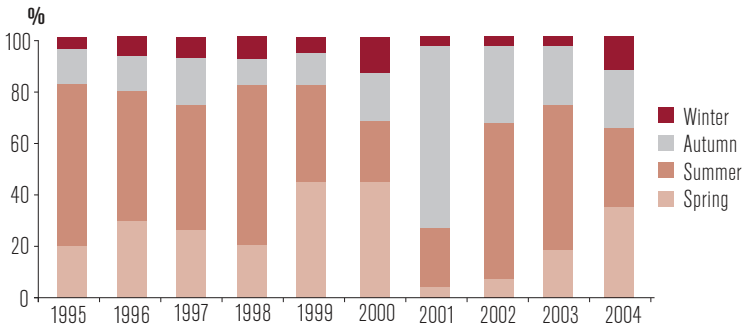

Figure: Seasonal distribution of malaria cases between 1995 and 2004 in Adana

rise of malaria rate among feverish cases (Table 3). Malaria positivity ratio in feverish patients are in compliance with the findings of another study conducted in a city, which is similar to Adana in terms of geographical structure and population movements.[19]

In this study, it was found that the malaria cases were more frequent in men, as complying with the findings of the preceding studies.[19, 21] This situation may be caused by more frequent contact of men with vectors due to working and traveling conditions, when compared with women. The change of urban character of malaria to rural in the area is an indicator of the improvement of the environmental health services and of the vector control in cooperation with different sectors, which probably resulted more efficient starting in the city center after 1997. Recent studies in the literature also support our finding of observation of malaria more frequently in rural areas.[22, 23]

But as data indicated, at the end of 10 years evaluated, the decrease in frequency comprised all localities in the province with a resulting overall success.

When the seasonal distribution of malaria cases was examined in a manner comprising the whole decade, it was found that the case frequencies, which decreased starting from the autumn (16.8%) through the winter (3.7%), showed an upward trend starting in the spring (23.0%) and reaching a peak value in the summer (56.5%). But this expected pattern was found to change shifting towards the spring starting from 1999 and finishing with a peak in the autumn of 2001. The peaking season was observed as the summer from 2002 on, the second ranking continued to be occupied by the autumns throughout 2002 and 2003. The expected summer-spring-autumn-winter ranking order pattern was re-established in 2004 (Table 5) (Figure). Malaria frequency in Adana, which began increasing in May, peaked in summers and began decreasing in October, showed the expected summer-spring-autumn-winter ranking in compliance with other studies in the literature[1, 24, 25] and it is strictly linked with vector behavior→

affected by environmental factors like temperature and humidity.[1, 26, 27] The peaking months are also the time with intensive seasonal population movements, especially of migrant farm workers, who settle in tents, located near reeds or water sources.

The living and environmental conditions of seasonal farm workers was found to pose a great risk for malaria for these people and was similarly reported by other authors,.[28- 30] in addition to the effect of poverty on malaria.[31]

CONCLUSION

In a peri-millennial context, the malaria has decreased its proportion among the disease load in the region and the whole country, effectuated by a long-term successful anti-malarial policy and a powerful health organization. But the surveillance system should be sustained, in addition to a meticulous supervision of the outcomes of mass movements, enforced by the cooperation between health professionals and the members of other related sectors.

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