

Hypertension and its determinants among primary-school children in Kuwait: an epidemiological study

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ضغط الدم المرتفع ومحدداته بين تلاميذ المدارس الابتدائية في الكويت: دراسة وبائية
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الشيخ

خلاصة: تم اختيار عينة عشوائية طبقية متعددة المراحل عددها 1312 تلميذاً تتراوح أعمارهم بين السادسة والعاشرة، وذلك من المناطق الخمس بالكويت. وأجريت مقابلات مع الآباء، وتم تسجيل أوزان الأطفال وأطوالهم، وكذلك تحليل عينات من بولهم. كما تم قياس ضغط دم كل منهم في ثلاث مرات منفصلة على الأقل. وتبين أن معدل انتشار ضغط الدم المرتفع بصورة عامة (حيث يكون متوسط ضغط الدم الانقباضي والانبساطي أو كليهما أكبر من 95 من المئينات بالنسبة للعمر والجنس) كان 5.1%. وفي تحليل التحرف (الانحدار اللوجستي المتعدد المتغيرات، وجد أن بعض فئات التلاميذ الكويتيين كانوا أكثر عرضة بكثير من غيرهم للإصابة بضغط الدم المرتفع. ومن بين هؤلاء الأطفال ذوو الوالدين الأقارب، ومن في عائلاتهم مرضى بارتفاع ضغط الدم، والأطفال المصابون بالسمنة.

ABSTRACT A multistage, stratified random sample of 1312 students (aged 6–10 years) was selected from the five regions in Kuwait. Parents were interviewed and weight, height and urino analysis of the children were taken. Blood pressure was measured on at least three separate occasions. The overall prevalence of hypertension (average systolic and/or diastolic blood pressure > 95th percentile for age and sex) was 5.1%. In multivariate logistic regression analysis, certain groups of Kuwaiti schoolchildren were much more likely to develop hypertension. They included children whose parents were consanguineous, children with a family history of hypertension and obese children.

L'hypertension et ses déterminants chez les élèves des écoles primaires à Koweït: étude épidémiologique

RESUME Un échantillon aléatoire stratifié à plusieurs degrés de 1312 écoliers (âgés entre 6 et 10 ans) a été choisi dans cinq régions de Koweït. Les parents ont été interviewés et les enfants ont été pesés et mesurés et on a procédé à une analyse de leur urine. Leur tension artérielle a été prise en trois occasions distinctes au minimum. La prévalence globale de l'hypertension (pression artérielle systolique et diastolique > 95^e du percentile pour l'âge et le sexe) était de 5,1%. Dans l'analyse de régression logistique multivariée, certains groupes d'enfants koweïtiens étaient bien plus susceptibles de développer une hypertension. Ils comprenaient les enfants de parents consanguins, ceux qui avaient des antécédents familiaux d'hypertension et les enfants obèses.

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Introduction

Adult hypertension is a major health problem and drug treatment of hypertension is expensive and has adverse side-effects. By the time treatment of hypertension begins during adulthood, considerable damage may have already been done to the arterial system, to the left ventricle and to other organs. Thus, from several points of view, prevention is preferable to treatment [1]. There are indications that the development of adult hypertension may start very early in life [2,3], and children maintain their position in the blood pressure distribution over time [4,5]. Several important follow-up studies have demonstrated that children with persistent high blood pressure values are at increased risk of becoming hypertensive adults [6,7]. These longitudinal studies have affirmed the tracking phenomenon of blood pressure in children.

There have been few studies on hypertension in Kuwaiti children. The aim of the present work was to study the prevalence of hypertension and some related risk factors among Kuwaiti primary-school children.

Subjects and methods

Kuwait covers an area of 17 818 km². The estimated total population in 1996 was 1 753 881. Kuwait's population resides around Kuwait City. Administratively, the country is divided into five governorates: Kuwait City, Hawalli, Farwaniya, Al-Ahmedi and Al-Jahra.

A multistage, stratified random sampling technique was used to select sample schools from the five regions, with two primary schools chosen randomly from each governorate, one for boys and another for girls. From each school, four classes were selected at random, one from each of the four primary grades. Only Kuwaiti prima-

ry-school children were included in the study.

Through questionnaire interviews with parents, data were collected regarding age, sex, and birth order of the child, age of parents when the child was born, socioeconomic data such as education and occupation of parents, family size, crowding index and social level (high or low based on parental education and occupation, and income per capita), family history of hypertension, consanguinity among parents, physical exercise, scholastic achievement (using results of the mid-year exam), and eating habits regarding the consumption of salty foods.

For each child, weight, to the nearest 0.1 kg in light clothes, was measured using calibrated scales, and height, to the nearest 0.1 cm without shoes was taken using calibrated height stands. Body mass index (BMI) was calculated; children whose BMI was ≥ 25 kg/m² were considered obese [8]. Urine analysis was performed to exclude secondary hypertension due to kidney disease using Ames Multistix 10SG strips with a sensitivity of 0.3 g/L albumin (Ames Division, Miles Laboratories Limited, Stoke Court, United Kingdom). Students with a known history of secondary hypertension were excluded.

Blood pressure was measured in a sitting position after 5 minutes of rest using a standardized mercury sphygmomanometer. Phase I Korotkoff sound (K1) was used to indicate systolic blood pressure. Phase IV Korotkoff sound (K4), characterized by a low-pitched muffled sound, was used to indicate diastolic blood pressure. This is because the fifth phase (K5), which is characterized by the disappearance of all sounds, cannot be detected in all children under 13 years. Blood pressure was measured on at least three separate occasions and average readings were recorded for

each child. Percentile curves for systolic and diastolic blood pressure were developed based on sex and age [9]. Hypertension was defined as an average systolic and/or diastolic blood pressure > 95th percentile for age and sex. Trained physicians conducted the examinations for the whole project. To avoid interobserver and intra-observer variation, intensive training and standardized procedures were adopted.

Data were compiled, sorted and coded. Data were analysed using SPSS. The chi-squared test and Student *t*-test were used as tests of significance at the 5% level. Crude odds ratio and 95% confidence intervals (CI) were calculated to identify the risk of developing hypertension. Multivariate analysis was then performed. Maximum likelihood estimates of combined odds ratios and their corresponding 95% CI adjusted for confounders were obtained by multiple logistic regression.

Results

The original sampling comprised 1350 Kuwaiti students aged 6–10 years. Of those, 1312 (619 boys and 693 girls) were included, a response rate of 97.2%. Table 1 shows the 95th percentile values (in mmHg) for systolic and diastolic blood pressure of Kuwaiti primary-school children by age and sex.

The overall prevalence of hypertension (defined as the average systolic and/or diastolic blood pressure greater than the 95th percentile for age and sex) was 5.1%. The prevalence among males (5.7%) was not significantly different from females (4.6%) ($\chi^2 = 0.73$, $P > 0.05$).

In univariate analysis, there were no significant differences in the prevalence of hypertension by certain sociodemographic and biological factors. These variables did not meet the $P < 0.1$ criterion for inclusion

Table 1 95th percentile values (mmHg) for systolic and diastolic blood pressure of Kuwaiti primary-school children by age

Age (years)	Systolic blood pressure (mmHg)		Diastolic blood pressure (mmHg)	
	Males	Females	Males	Females
6	120	118	75	75
7	123	120	76	76
8	125	122	78	77
9	127	125	80	78
10	130	127	80	80

in the multivariate analysis model. They included: age of the child, sex, birth order, parental education and occupation, age of the parents when the child was born, family income, child's scholastic achievement and crowding index.

After adjusting for all other variables, multivariate analysis indicated that certain groups of Kuwaiti schoolchildren were much more likely to develop hypertension (Table 2). They included children whose parents were consanguineous, children with a family history of hypertension and obese children.

Discussion

Measuring blood pressure during childhood is of particular interest because it may be possible to identify those individuals with early essential hypertension or those at high risk for the development of sustained essential hypertension later in life [10,11]. We developed a local percentile distribution based on sex and age to be used as a guideline for detecting children with elevated blood pressure. Accordingly, the overall prevalence of hypertension among primary-school children in Kuwait was

Table 2 Multivariate logistic regression model of potential risk factors of hypertension in Kuwaiti primary-school children

Variable ^a	OR ^b	95% CI
Sex (male versus female)	1.13	0.78–1.45
Consanguineous parents	1.61	1.11–3.56
Family history of hypertension	1.55	1.01–2.59
Social class (high versus low)	1.22	0.88–1.68
Obesity (body mass index ≥ 25 kg/m ²)	1.41	1.09–2.93
Regularly performing physical exercise	0.92	0.77–1.23
High consumption of salty food	1.39	0.85–2.11

^aAll variables listed met the $P < 0.1$ criterion for inclusion

^bEach odds ratio was adjusted for all other variables in the table

OR = odds ratio

CI = confidence interval

found to be 5.1%. A similar figure of 4.8% has been reported among primary-school children in Saudi Arabia [12].

We found heredity to be an important risk factor. Kuwaiti children of consanguineous parents and those having a family history of hypertension were found to be much more likely to develop hypertension. A genetic predisposition to hypertension appears to interact with obesity, lifestyle, dietary components and other factors to produce elevated blood pressure [13,14]. Kuwait's population is a mosaic of large and small minorities representing most Arab communities. In general, Kuwait's population is characterized by rapid growth, large families, high rates of con-

sanguineous marriage within the Arab communities but with a low frequency of inter-marriage between them, and the presence of genetic isolates and semi-isolates in some extended families and Bedouin tribes [15]. The rate of consanguineous marriage in Kuwait has been reported to be 54.3%, with estimated population incidence rates ranging from 52.9% to 55.7% [16]. First-cousin marriages are the most frequent type and the average inbreeding coefficient is 0.0219, which is considered high [16].

We showed that obesity is associated with high blood pressure among children. It has been suggested that body fat patterning plays a role in the etiology of hypertension [17]. Studies in industrialized countries have shown that systolic and diastolic blood pressures are significantly higher in obese than in non-obese children [18]. BMI and the prevalence of obesity increased among Kuwaitis between 1980–81 and 1993–94, probably due to the effects of modernization, affluence, increased food consumption and increasingly sedentary lifestyles [19].

Control of hypertension from the public health viewpoint requires the identification of the risk factors, awareness of which can lead to programmes of primary prevention in the population at greatest risk.

Conclusion

Our results indicate the need for different approaches to the prevention of hypertension and cardiovascular risk in high-risk and low-risk children and for boys and girls. Future interventions to improve the health and nutritional status of Kuwaiti children should be culturally appropriate and implemented at the levels of individuals, families and communities.

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