Nonalcoholic Fatty Liver Disease of Two Ethnic Groups in Kuwait: Comparison of Prevalence and Risk Factors

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Key Words

Nonalcoholic liver steatosis · Arabic ethnicity · South Asian ethnicity · Obesity

Abstract

Objectives: To assess the prevalence of nonalcoholic hepatic steatosis (nonalcoholic fatty liver disease, NAFLD) and the significance of some risk factors, such as obesity and glucose metabolism impairment, for two major ethnic groups of Kuwait: Arabs and South Asians. **Subjects and Methods:** 143 adults (Arab: n = 81; South Asian: n = 62) were enrolled in the study. Anthropometric measurements including body mass index (BMI), waist circumference (WC), hip circumference (HC) and waist-to-hip ratio were performed along with abdominal ultrasonography. The prevalence of liver steatosis was assessed; its relation to glucose metabolism impairment, obesity, age and gender was compared in the two ethnic groups. **Results:** Except for waist-to-hip ratio, the anthropometric parameters were higher in Arabs than South Asians. The respective parameters in Arabs and South Asians were: BMI: 30.9 ± 6.6 versus 27.0 ± 4.5 , $p < 0.001$; WC: 101.5 ± 16.4 versus 94.0 ± 12.2 , $p = 0.002$; HC: 106.6 ± 12.4 versus 99.2 ± 9.9 , $p < 0.001$. Although Arabs were more obese, they did not exhibit a higher prevalence of steatosis (33.3 vs. 29.0%, $p = 0.583$). According to multivariate analysis, only

gender (odds ratio 3.93, $p = 0.005$), glucose metabolism impairment (odds ratio 4.94, $p = 0.003$) and WC (odds ratio 4.75, $p = 0.012$) remained significantly associated with steatosis. **Conclusion:** No significant difference in NAFLD prevalence was found between Arabs and South Asians. Only gender, history of impaired glucose metabolism and abdominal obesity expressed by WC had an independent predictive value for developing liver steatosis. Copyright © 2011 S. Karger AG, Basel

Introduction

Liver steatosis is a common reaction of the liver to a variety of noxious stimuli and metabolic disturbances [1]. Nonalcoholic fatty liver disease (NAFLD) is a very frequent form of chronic liver disease. Insulin resistance is recognized as a key promoter of NAFLD, reflected by any kind of glucose metabolism derailment – either type 2 diabetes, or any type of ‘prediabetes’ [2–9]. According to the published data, the strongest association of NAFLD is with central, not overall obesity [8, 10], with intense links to metabolic syndrome. The pandemic of obesity appears to be a global problem, potentially leading from simple steatosis to necroinflammation and finally cirrhosis [2–7]. Patients with nonalcoholic steatohepatitis are at

Table 1. Characteristics and anthropometric measurements of the two ethnic groups

Variable	Arabs (n = 81)	Asians (n = 62)	All (n = 143)	p value
Gender				0.140 ^a
Male	28 (34.6)	29 (46.8)	57 (39.9)	
Female	53 (65.4)	33 (53.2)	86 (60.1)	
Diabetes				0.295 ^a
Yes	15 (18.5)	16 (25.8)	31 (21.7)	
No	66 (81.5)	46 (74.2)	112 (78.3)	
Steatosis				0.583 ^a
Yes	27 (33.3)	18 (29.0)	45 (31.5)	
No	54 (66.7)	44 (71.0)	98 (68.5)	
Age, years	37.9 ± 12.7	40.0 ± 10.2	38.8 ± 11.7	0.301 ^b
BMI, kg/m ²	30.9 ± 6.6	27.0 ± 4.5	29.2 ± 6.1	<0.001 ^b
WC, cm	101.5 ± 16.4	94.0 ± 12.2	98.2 ± 15.2	0.002 ^b
HC, cm	106.6 ± 12.4	99.2 ± 9.9	103.4 ± 12.0	<0.001 ^b
WHR	0.95 ± 0.08	0.95 ± 0.06	0.95 ± 0.07	0.863 ^b

Data for gender, diabetes and steatosis shown as number and percent (in parentheses) of patients, for other variables as mean ± SD. Diabetes included any glucose metabolism derailment.

^a p values generated by χ^2 test to compare between Arabs and Asians.

^b p values generated by Student's t test to compare between Arabs and Asians.

Table 2. Prevalence of steatosis based on characteristics and anthropometric parameters (n = 123)

Variable	Steatosis		p value	Variable	Steatosis		p value
	n (%)	95% CI			n (%)	95% CI	
Gender			<0.001 ^a	WC, cm			<0.001 ^b
Male	28 (49.1)	35.6–62.7		Tertile 1	1 (3.2)	0.1–16.7	
Female	17 (19.8)	12.0–29.8		Tertile 2	9 (20.0)	9.6–34.6	
Age, years			0.025 ^b	Tertile 3	35 (52.2)	39.7–64.6	
<30	7 (20.0)	8.4–36.9		HC, cm			0.003 ^b
30–40	16 (28.6)	17.3–42.2		Tertile 1	8 (21.1)	9.6–37.3	
>40	22 (42.3)	28.7–56.8		Tertile 2	10 (20.4)	10.2–34.3	
Ethnicity			0.583 ^a	Tertile 3	27 (48.2)	34.7–62.0	
Arab	27 (33.3)	23.2–44.7		WHR			<0.001 ^b
Asian	18 (29.0)	18.2–41.9		Tertile 1	3 (9.1)	1.9–24.3	
Diabetes			<0.001 ^a	Tertile 2	8 (22.2)	10.1–39.2	
Yes	20 (64.5)	45.4–80.8		Tertile 3	34 (45.9)	34.3–57.9	
No	25 (22.3)	15.0–31.2					
BMI, kg/m ²			<0.001 ^b	Diabetes included any glucose metabolism derailment.			
Tertile 1	3 (8.3)	1.8–22.5		^a p values generated by χ^2 test.			
Tertile 2	13 (28.9)	16.4–44.3		^b p values generated by χ^2 for linear trend.			
Tertile 3	29 (46.8)	34.0–59.9					

Table 3. Prevalence of steatosis among Arabs and Asians according to their characteristics

Variable	Arabs (n = 81)		p value	Asians (n = 62)		p value
	steatosis			steatosis		
	n (%)	95% CI		n (%)	95% CI	
Gender			0.001 ^a			0.045 ^a
Male	16 (57.1)	37.2–75.6		12 (41.4)	23.5–61.1	
Female	11 (20.8)	10.8–34.1		6 (18.2)	7.0–35.5	
Age, years			0.016 ^b			0.046 ^b
<30	5 (21.7)	7.5–43.7		2 (16.7)	2.1–48.4	
30–40	8 (25.0)	11.5–43.4		8 (33.3)	15.6–55.3	
Diabetes			0.002 ^a			0.001 ^b
Yes	10 (66.7)	38.4–88.2		10 (62.5)	35.4–84.8	
No	17 (25.8)	15.8–38.0		8 (17.4)	7.8–31.4	
BMI, kg/m ²			<0.001 ^b			0.175 ^b
Tertile 1	0 (0.0)	0.0–21.8		3 (14.3)	3.0–36.3	
Tertile 2	4 (18.2)	5.2–40.3		9 (39.1)	19.7–61.5	
Tertile 3	23 (52.3)	36.7–67.5		6 (33.3)	13.3–59.0	
WC, cm			<0.001 ^b			0.003 ^b
Tertile 1	1 (6.7)	0.2–31.9		0 (0.0)	0.0–20.6	
Tertile 2	1 (4.8)	5.2–40.3		8 (33.3)	15.6–55.3	
Tertile 3	25 (55.6)	36.7–67.5		10 (45.5)	24.4–67.8	
HC, cm			0.002 ^b			0.340 ^b
Tertile 1	3 (20.0)	4.3–48.1		5 (21.7)	7.5–43.7	
Tertile 2	3 (11.1)	2.4–29.2		7 (31.8)	13.9–54.9	
Tertile 3	21 (53.8)	37.2–69.9		6 (35.3)	14.2–61.7	
WHR			0.004 ^b			0.006 ^b
Tertile 1	2 (10.0)	1.2–31.7		1 (7.7)	0.2–36.0	
Tertile 2	4 (26.7)	7.8–55.1		4 (19.0)	5.4–41.9	
Tertile 3	21 (45.7)	30.9–61.0		13 (46.4)	27.5–66.1	

Diabetes included any glucose metabolism derailment.

^a p values generated by χ^2 test.

^b p values generated by Fisher's exact test.

increased risk of premature death compared to the general population [11]. In our previous study [12], we showed that the two main ethnic groups in Kuwait differed in the degree and the type of obesity and its impact on some metabolic risk factors of atherosclerosis. Therefore, the aim of this study was to clarify the significance of the differences for the prevalence of NAFLD.

Subjects and Methods

The study was conducted from January 2007 to September 2008. 143 adult subjects, patients and clients of the Medical Clinic in Al Rashid Hospital, Kuwait were examined (Arabs: n = 81, South Asians: n = 62; age range: 18–64 years). The Arabs were

from Kuwait, Saudi Arabia, United Arab Emirates, Jordan, Egypt and Syria. The South Asians were from India, Pakistan, Bangladesh or Sri Lanka. Ethnicity was established based on official documents showing country of origin and the person's own confirmation of the data. Exclusion criteria were: presence of chronic liver disease other than NAFLD, chronic wasting conditions, diabetes type 1, history of jejunoileal bypass surgery, alcohol and/or substance abuse, chronic medication with potential hepatotoxicity, pregnancy, and conditions with fluid retention. Basic anthropometric measurements were done by a qualified and properly trained nurse. A nonstretchable tape was used for measurements of circumferences while the persons were in an upright position. The waist circumference (WC) was taken in the middle between the rib cage and the pelvis as the shortest circumference. The hip circumference (HC) was measured as the largest circumference at the level of greater trochanters. Body weight was checked by an electronic scale and the height was measured by a measuring rod

Table 4. Comparison of anthropometric measures according to steatosis (mean $\pm$ SD)

Variable	Steatosis		p value
	yes (n = 45)	no (n = 98)	
Arabs			
Age, years	43.6 ± 13.5	35.1 ± 11.4	0.004
BMI, kg/m ²	34.9 ± 5.9	28.9 ± 6.1	<0.001
WC, cm	111.8 ± 15.9	96.3 ± 14.2	<0.001
HC, cm	112.9 ± 13.0	103.5 ± 11.0	0.001
WHR	0.99 ± 0.07	0.93 ± 0.07	0.001
Asians			
Age, years	44.0 ± 12.0	38.3 ± 9.0	0.046
BMI, kg/m ²	28.7 ± 4.4	26.3 ± 4.4	0.054
WC, cm	99.7 ± 10.1	91.7 ± 12.3	0.017
HC, cm	102.2 ± 10.7	97.9 ± 9.4	0.126
WHR	0.98 ± 0.05	0.93 ± 0.06	0.013
All			
Age, years	43.8 ± 12.8	36.5 ± 10.5	0.001
BMI, kg/m ²	32.4 ± 6.1	27.7 ± 5.6	<0.001
WC, cm	107.0 ± 15.0	94.2 ± 13.5	<0.001
HC, cm	108.6 ± 13.1	101.0 ± 10.6	0.001
WHR	0.98 ± 0.06	0.93 ± 0.07	<0.001
p values are generated by Student's t test.			

attached to the same scale. Ultrasound examination of the upper abdomen was performed by a consultant radiologist skilled in the method and blind to the exact purpose of the examination. The criteria for steatosis were: increased parenchymal echogenicity of the liver compared to the kidney, vascular blurring, and deep attenuation of the ultrasound beam. Patients were either directly tested, or questioned regarding their previous history of diabetes, taking into account any derailment in glucose metabolism related to type 2 diabetes, including both impaired glucose tolerance and impaired fasting blood glucose.

Statistical Methods

All statistical analyses were performed using STATA (SE 8.2, StataCorp, College Station, Tex., USA). A $p < 0.05$ was used as the threshold for statistical significance. The χ^2 test, χ^2 test for linear trend or Fisher's exact test were used to assess the association between two qualitative variables wherever appropriate. The 95% confidence intervals (CI) for the prevalence of steatosis were calculated using binomial distribution. Quantitative variables were compared between steatosis and nonsteatosis groups using an independent samples t test. Unadjusted odds ratios and their 95% CI were calculated separately for different risk factors in the prevalence of steatosis. Multiple logistic regression was used to estimate the risk of these factors in the prevalence of steatosis after controlling for confounding among them. The adjusted odds ratios and their 95% CI for associated factors were computed from the coefficients of the logistic regression model.

Results

The parameters studied and characteristics of the two ethnic groups are shown in table 1. Previous history of glucose metabolism impairment, prevalence of steatosis and age were similar in both groups. Mean values of body mass index (BMI), WC, and HC were higher in Arabs than South Asians and the differences were statistically significant: BMI: 30.9 $\pm$ 6.6 versus 27.0 $\pm$ 4.5, $p < 0.001$; WC: 101.5 $\pm$ 16.4 versus 94.0 $\pm$ 12.2, $p = 0.002$; and HC 106.6 $\pm$ 12.4 versus 99.2 $\pm$ 9.9, $p < 0.001$. The waist-to-hip ratio (WHR) was similar in Arabs (0.95 $\pm$ 0.08) and South Asians (0.95 $\pm$ 0.06); the difference was not statistically significant ($p = 0.863$).

The prevalence of steatosis according to characteristics and anthropometric parameters is shown in table 2. Gender was highly predictive for the incidence of steatosis: the incidence was male: 49.1%; female: 19.8%. The difference was statistically significant ($p < 0.001$). There was no difference among the two ethnic groups in incidence rate: Arabs 33.3% and South Asians 29.0% ($p = 0.683$). Age was a predictor of incidence of steatosis, showing a linear trend ($p = 0.025$). We found highly significant as-

Table 5. Risk factors associated with steatosis by logistic regression analyses among the studied sample

Variable	Univariate analysis			Multivariate analysis		
	crude odds ratio	95% CI	p value	adjusted odds ratio	95% CI	p value
Gender						
Female	1.00			1.00		
Male	3.92	1.86–8.23	<0.001	3.93	1.53–10.10	0.005
Age, years						
<30	1.00			1.00		
30–40	1.60	0.58–4.40	0.362	0.86	0.25–2.92	0.804
>40	2.93	1.09–7.93	0.034	1.21	0.33–4.40	0.773
Ethnicity						
Arab	1.00			1.00		
Diabetes						
No	1.00			1.00		
Yes	6.33	2.68–14.95	<0.001	4.94	1.71–14.24	0.003
BMI, kg/m ²						
Tertile 1 and 2	1.00			1.00		
Tertile 3	3.57	1.70–7.49	0.001	1.26	0.39–4.13	0.699
WC, cm						
Tertile 1 and 2	1.00			1.00		
Tertile 3	7.22	3.18–16.39	<0.001	4.75	1.40–16.11	0.012
WHR						
Tertile 1 and 2	1.00			1.00		
Tertile 3	4.48	2.03–9.88	<0.001	1.48	0.51–4.32	0.474
Diabetes included any glucose metabolism derailment.						

sociations between the presence of glucose metabolism impairment and steatosis (64.5% steatosis among diabetics vs. 22.3% in nondiabetics, $p < 0.001$), and all anthropometric measures of obesity (expressed as linear trends between tertiles with $p < 0.001$ for BMI, WC and WHR, and $p = 0.003$ for HC) and steatosis as well.

The prevalence of steatosis among Arabs and Asians based on their characteristics and the anthropometric measurements is shown in table 3. In Arabs, gender ($p = 0.001$), history of diabetes ($p = 0.02$) and all measures of obesity were significantly associated with steatosis ($p = 0.001$ for BMI and WC, $p = 0.002$ for HC and $p = 0.004$ for WHR). In South Asians, gender ($p = 0.045$), history of glucose metabolism impairment ($p = 0.001$), WC ($p = 0.003$) and WHR ($p = 0.006$) were significantly associated with steatosis. In both ethnic groups age was associated with steatosis ($p = 0.016$ and $p = 0.046$ for Arabs and South Asians, respectively).

The comparison of anthropometric measures in relation to steatosis is shown in table 4. Among Arabs, steato-

sis was associated with higher age (43.6 ± 13.5 years for steatosis vs. 35.1 ± 11.4 years without steatosis, $p = 0.004$), higher values of BMI (34.9 ± 5.9 vs. 28.9 ± 6.1 , $p < 0.001$), WC (111.8 ± 15.9 vs. 96.3 ± 14.2 , $p < 0.001$), HC (112.9 ± 13.0 vs. 103.5 ± 11.0 , $p = 0.001$) and WHR (0.99 ± 0.07 vs. 0.93 ± 0.07 , $p = 0.001$). These associations were statistically highly significant. Among South Asians, associations existed between steatosis and age (44.0 ± 12.0 vs. 38.3 ± 9.0 , $p = 0.046$ for steatosis and nonsteatosis subgroup, respectively), WC (99.7 ± 10.1 vs. 91.7 ± 12.3 , $p = 0.017$) and WHR (0.98 ± 0.05 vs. 0.93 ± 0.06 , $p = 0.013$). Overall, age was significantly related to steatosis (43.8 ± 12.8 vs. 36.5 ± 10.5 , $p = 0.001$) for the entire group studied. Significant correlations were present between steatosis and BMI, WC, WHR ($p < 0.001$) and HC ($p = 0.001$) as well.

Risk factors associated with steatosis by logistic regression analyses are given in table 5. After multivariate analysis only gender (odds ratio 3.93, $p = 0.005$), history of glucose metabolism impairment (odds ratio 4.94, $p =$

0.003) and WC (odds ratio 4.75, $p = 0.012$) remained statistically significantly associated with steatosis. No statistical significance was found between steatosis and age, ethnicity, BMI or WHR.

Discussion

In our study, abdominal type obesity, defined through WC, was confirmed to be linked with steatosis in both ethnic groups, after adjustment for all other variables. Along with this association, we observed statistically significant differences between the two studied ethnicities: Arabs were more obese than South Asians based on BMI, WC and HC. In spite of that, the prevalence of glucose metabolism impairment and occurrence of steatosis in the two groups were similar. This finding is similar to the results of our former study [12]: the same degree of obesity had more deleterious metabolic effects in South Asians than Arabs in Kuwait. Previous studies, too, confirmed that the South Asian ethnicity carries a higher genuine risk to exhibit adverse effects of obesity, in comparison with other ethnic groups, namely the Caucasians [13]. The overall prevalence of liver steatosis in our study was 31.5%. We found a very strong correlation between steatosis and a history of glucose metabolism impairment. This confirms the fact that insulin resistance is a main risk factor for developing NAFLD [2–9, 14]. The prevalence of NAFLD is not equal in different ethnicities [15–21]. The information about the different impact of obesity on developing NAFLD between Arabs and South Asians was lacking to date. We found some differences between our two studied ethnic groups: in Arabs, all studied anthropometric parameters were predictors of liver steatosis, contrary to the South Asians, where only

WC and WHR were predictors of steatosis. In a multivariate analysis, however, WC remained the only anthropometric parameter related to steatosis, along with male gender and a history of impaired glucose metabolism. After adjustment for all other variables, the risk of steatosis for males was 4 times higher than for females. It is possible to speculate to what extent the differences were a result of specific lifestyle habits, with daily activities shifted to the late night hours (main meal consumed late at night), along with specific dietary habits both of which could lead to multiple metabolic impairment [22].

Conclusion

Our study confirmed that the prevalence of NAFLD is quite high in two major ethnic groups in Kuwait: Arabs and South Asians, and despite Arabs being more obese, the prevalence of steatosis did not differ from South Asians. The history of impaired glucose metabolism was a strong link to NAFLD. WC was an independent predictor of NAFLD in both ethnic groups, and NAFLD was much more common in the male population of Kuwait. The main limitation of our study is the small sample size and to some extent, the selective segment of the Kuwait population studied. Despite this, some careful extrapolations are possible to be done towards the whole Arab and South Asian population in Kuwait.

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