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RESEARCH PAPER

Predictors of obesity in school-aged Jordanian adolescents

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Predictors of obesity in school-aged Jordanian adolescents

This cross-sectional study aimed to estimate the frequency of overweight and obesity in adolescents as defined by the International Obesity Task Force, and to estimate the effect of sociodemographic and health behaviours (eating habits and physical activity) that predict obesity. A stratified (by gender) random sample of 518 adolescents, aged 15 or 16 years was obtained from eight public schools in Amman. In this sample 17.5% were overweight and 9.6% were obese. The predictors of obesity and overweight (excess weight) were: (i) fathers attained primary and secondary education; (ii) total monthly family income $\geq$ 300 (JD); (iii) working mothers; (iv) family size $\leq$ 6; and (v) having obese parents. Eating a low quality diet (chips, candy) was a significant dietary predictor of excess weight. The family variables found to be important predictors along with a low quality diet suggest that family interventions would be necessary in the control of adolescent excess weight.

Key words: adolescents, family factors, Jordan, obesity, predictors.

INTRODUCTION

Overweight and obesity (referred to as 'excess weight') and their health consequences have been recognized as major public health problems worldwide.[1] Over the past two decades a significant increase in the prevalence of overweight and obesity in children and adolescents has been documented in many developing and developed countries.[1] The most significant long-term consequences of childhood and adolescent overweight and obesity are their persistence into adulthood with all of the attendant health risks,[2,3] such as coronary heart diseases, high blood pressure, hyperinsulinaemia, type 2 diabetes, dyslipidaemia, arthritis and psychological problems that adversely impact the overall quality of life[1,4–6] Additionally, excess weight is costly to the person and society.[7] Jordan experienced a rapid nutritional transition that was accompanied by economic growth, urbanization and dramatic improvement in living conditions. This transition has affected the Jordanian population's health and

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lifestyle.[8] These lifestyle changes have mostly affected Jordanian children and adolescents. The Jordanian population is characterized by a population distribution with a majority of the population being youths, with 68.6% of citizens under the age of 25 years and the largest age groups (24%) are in the 10- to 18-year-old category.[9] The most recent estimates for Jordan carried out 2 years ago showed that 14.3% and 3.9% of adolescent boys and girls are either overweight or obese, and the prevalence in adults is even higher.[10,11] How obesity develops is not entirely understood and it is thought to be a multifactorial disorder.[12] Therefore, identifying factors that influence the development of obesity in adolescents remains a necessary first step to addressing the problem. Several cross-sectional studies in Western countries have shown that overweight and obese adolescents are less physically active than non-obese subjects, and physical inactivity, socioeconomic background and dietary transition were found to be major factors.[13] However, studies on the factors that contribute to the development of obesity in Jordanian adolescents are limited and the few available studies have focused on adolescent boys only and did not include the effects of sociodemographics. This study aims to describe the frequencies of overweight and obesity in Jordanian adolescents, aged 15 or 16 years, and to examine the significance of sociodemographic variables (age, gender, family income, parent's education and employment), and health behaviours (eating habits and physical activity) in predicting obesity. The current study focuses on obesity of middle adolescence phase, because this age group is characterized by increased mobility, more peer relations and greater financial autonomy. They typically become more independent in their decision-making and lifestyle behaviours than younger adolescent, which makes them more vulnerable to obesity problems.[14] Hopefully, identification of predictive factors would allow health-care providers to design intervention strategies to prevent the onset of obesity in adolescents.

RESEARCH METHODS

Study design

A cross-sectional study design using a school-based survey was used. A simple stratified random sample of adolescents aged 15 and 16 years was obtained. Because Jordanian elementary schools are separated for boys and girls, eight schools from the four public directorates of Amman (four for boys and four for girls) were randomly selected, and 12 classrooms from 39 classrooms (six for boys and six for girls) were again selected randomly. All students in these 12 classes were invited to participate as a group. Adolescents limited in physical activity or receiving medical care for endocrine or metabolic problems were excluded.

Data collection procedures

The University of Jordan Committee on Human Research reviewed and approved this study. Permissions to conduct the study were obtained from Ministry of Education of each public educational directorate, and from each participating school. A signed consent form was also obtained from parents of all participating adolescents. Students were assured that their participation is voluntary and anonymous. Well-trained, baccalaureate-prepared nurses assisted the primary investigator (PI) in data collection, and inter-rater reliability between the PI and the nurse data collector was 0.99. Students completed a brief self-report questionnaire during the classroom period and recorded their responses directly on a two-part questionnaire: the sociodemographic part included questions pertaining to adolescent's age, gender and socioeconomic status (parents' level of educations, family income and employment). The dietary and sedentary lifestyle behaviours were assessed by using the Arabic version questions from General School Health Based Survey (GSHS) structured questionnaire on risk factors of non communicable diseases developed by Centers for Disease Control in collaboration with World Health Organization.

Measurements

Dietary behaviours were assessed by using 22 questions from GSHS dietary module. Adolescents were asked how many times during the last 30 days they consumed fruits, vegetables, milk, soft drinks, and how many times during the last 7 days they consumed fast food, fatty diets, low quality diet (chips, candy and popcorn). Additionally, many questions ask about dietary patterns (skipping breakfast, snacking, eating regular meals, eating during television (TV) watching). The response options include ranges from 0 (never) to 7 times a day or categorical responses (never, rarely, sometimes, most of the time, always). The participants were grouped according to these response categories, so that characteristics of those with high versus low intake could be compared.

Physical activity and sedentary behaviours were assessed by using 10 questions from GSHS physical activity Module. Adolescents were asked how many days in the

past week, and also in a typical week they were physically active (i.e. participating in a cumulative activity including sports, school activities, playing with friends and walking to school) for 60 min or more. Response options ranged from 0 to 7 days for both questions; students were categorized as physically inactive if they were < 5 days/week active.[15] Adolescents were also asked how many hours they watched TV, played computer games, talked with friends, or did other sedentary activities, such as Atari, playing Station, playing cards, playing chess or reading, in their free time in a typical day. The possible responses were < 1, 2, 3–4, 5–6, 7–8, > 8 h/day. Students were considered sedentary if the hours of TV watching and time on the computer were more than 2 h daily.[16] Data collection took place between 12 and 31 August 2008

Anthropometry

Weight was measured using a standardized scale to the nearest 0.5 kg. This scale was checked for accuracy at the beginning of every data collection day by weighing an object of known weights and for zero balance before each measurement of student without shoes and wearing light clothes. Height was measured in centimetres using a fixed tape measure to the nearest 0.1 cm, with the adolescents standing straight against the wall, without shoes, heels together, and the adolescents' heals, buttocks, shoulders and head touching the vertical wall surface with line of sight aligned horizontally. An average of two readings was recorded for both weight and height. Body mass index (BMI) was calculated as weight (kilograms) divided by height (metres) squared.[17]

Data management and analysis

Descriptive statistics were performed using the Statistical Package of Social Sciences (SPSS) version 13 (SPSS Inc., Chicago, IL, USA). Using the IOTF international cut points for weight,[18,19] adolescents were categorized into four groups: underweight, normal weight, overweight and obese. For the purposes of the multivariate analysis normal and excess weight were used and underweight adolescent (4.6%) were excluded. A multiple logistic regression analysis was used to estimate the odds ratios (OR) and 95% confidence intervals (CI) for the OR of a set of predictors against the dependent variable excess weight. For all statistical tests, the significant level was set at $P < 0.05$.

RESULTS

Of 526 questionnaires distributed, 523 were fully completed with a response rate of 99.4%. Five questionnaires were excluded, two had medical condition of thyroid gland and three were outside the age range, with 518 participants remaining. Of the participants 48.3% were 15 years old, and 51.7% were 16 years old. Most of the students (92.1%) lived with both parents and only 7.9% lived in a single parent home. The majority of the adolescents came from large (61.2%) families of ≥ 6 siblings. The parents' sociodemographic characteristics were as follows: family income of half of the students was low (< 400 JD/month). The majority (61.5%) reported that their mothers had a ≤ secondary school education, whereas 87.5% of the fathers had ≥ secondary school education. Most the adolescents' mothers (85.1%) were homemakers, and 14.1% worked outside home (Table 1).

Description of weight distribution

Of the 518 adolescents, 17.5% were overweight, 9.6% were obese. However, 4.6% were considered underweight and about 68.1% were having ideal BMIs (Table 2).

Predictors of excess weight

Sociodemographics

The first multiple logistic regression model estimated the effect of 10 sociodemographic variables on excess weight. The result indicated that three variables were statistically significant independent predictors of excess weight: father's level of education, family size and parents' obesity (Table 3). Fathers with ≤ secondary education were more likely to have children with excess weight (OR = 1.70, 95% CI: 1.1, 2.6; $P > 0.01$), compared with those children whose fathers completed diploma or higher level of education; families with ≤ 6 members were more likely to have adolescents with excess weight than families with > 6 members (OR = 1.76, 95% CI: 1.2, 2.67; $P > 0.00$); adolescents of obese parents were likely to be obese than those of non-obese parents (OR = 2.29, 95% CI: 1.14, 4.45; $P > 0.02$).

Dietary behaviours

The second model estimated the predictive effect of 15 dietary behaviours on excess weight (Table 4). The results indicated that the only dietary variable that was a statistically significant predictor of excess weight was eating a low quality diet, such as chips, candy bars and popcorns (OR = 1.80, 95% CI: 1.11, 2.80; $P > 0.02$).

Table 1 Sociodemographic characteristics of the sample ($n = 518$)

Variable	%	N
Number of members per family		
≤ 6	38.8	201
> 6	61.2	317
Living conditions for the family		
Two parents	92.1	477
Single parent	7.9	41
Divorced	34.1	14
Deceased	46.3	19
Travelling	19.5	8
Student daily allowance (piasters)†		
≤ 50	68.0	350
> 50	32.0	165
Family income in JD per month#		
< 200	9.7	50
200–299	20.8	108
300–399	20.3	105
400–499	15.6	81
> 500	33.6	174
Father's occupation		
Working	92	460
Retired	8	58
Mother's occupation		
Housewife	85.1	441
Working outside the home	14.1	73
Father level of education		
Primary	12.4	63
Secondary	37.4	190
Diploma	18.6	95
Bachelor	24.7	126
Graduate studies or more	7.1	36
Mother level of education		
Illiterate	0.6	3
Primary	10.0	51
Secondary	51.8	264
Diploma	22.7	116
Bachelor	13.7	70
≥ Graduate studies	1.2	6
Obesity in parents		
Mother	16.6	86
Father	19.1	99
Both	13.9	72
Neither	50.4	261
Parents health condition‡		
Mother	6.8	35
Father	22.2	115
Both	5.2	27
Neither	65.8	341
Student history of chronic diseases (frequent visits to doctor)		
Acute illness	4.4	23
Healthy	95.6	495
Adolescent is a current smoker		
Yes	12.4	64

† 1 piaster = 1.42 cent, 1 JD = US$ 0.708; ‡ Health conditions include: diabetes mellitus, heart disease, high blood pressure, or, cancer.

Table 2 Frequency of weight status for the total sample and for adolescent boys and girls ($n = 518$)

Variable	All % ($n = 518$)	Boys % ($n = 258$)	Girls % ($n = 260$)
Underweight†	4.6 (24)	5.8 (15)	3.5 (9)
Normal weight	68.1 (353)	65.1 (168)	71.2 (185)
Overweight‡	17.5 (91)	16.2 (42)	18.8 (49)
Obesity§	9.6 (50)	12.8 (33)	6.5 (17)
Excess weight¶	27.1 (141)	29.0 (75)	25.3 (66)

† Student who were under weight according to Cole *et al.*[19] ‡ Students who were at or above the 85th percentile, but below the 95th percentile for BMI by age and sex based on reference data from Cole *et al.*[18] § Students who were at or above the 95th percentile for BMI by age and sex based on reference data from Cole *et al.*[18] ¶ Excess weight, overweight and obesity combined. (BMI percentiles for age and gender of > 85th percentile.

Table 3 Sociodemographic predictors of excess weight ($n = 501$)

Predictor	OR	95% CI	*P*-value
Age	1.45	0.98, 2.14	0.06
Gender	1.00	0.67, 1.49	0.98
Family income	1.54	0.97, 2.42	0.06
Mother level of education	1.61	0.74, 1.82	0.51
Father level of education	1.70	1.10, 2.60	0.01
Mother occupation	1.77	0.96, 3.26	0.06
Number of members per family	1.76	1.2, 2.67	0.00
Student daily allowance	0.98	0.64, 1.52	0.94
Parents obesity (both)	2.25	1.14, 4.45	0.02
Smoking behaviour	1.01	0.57, 1.81	0.96

Reference groups: aged 15 years; gender male; family income ≥ 300 JD/month; parent education ≤ secondary; household mother; family size ≤ 6 members; student daily allowance < 50 piasters; neither parents obesity; not smoker. OR, odds ratio; 95% CI, 95% confidence interval.

Physical activity

The third model estimated the predictive effect of 10 independent activity behaviours on excess weight (Table 5). The results showed that none of the 10 variables was independently statistically significant.

Table 4 Dietary predictors of excess weigh ($n = 501$)

Predictor	OR	95% CI	*P*-value
Eating breakfast	0.84	0.56, 1.27	0.42
Eating regular three meals	0.85	0.56, 1.29	0.45
Snacking	1.01	0.65, 1.54	0.97
Fruit consumption	1.13	0.73, 1.74	0.56
Vegetables consumption	1.05	0.68, 1.62	0.80
Milk consumption	0.73	0.48, 1.10	0.13
Soft drink	0.92	0.71, 1.20	0.57
Fast food	1.07	0.71, 1.60	0.74
High fat diet	0.92	0.59, 1.44	0.72
Low quality diet	1.80	1.11, 2.80	0.02
Eating during watching TV	0.76	0.49, 1.19	0.23
Food from home	0.86	0.57, 1.31	0.50
Purchasing food from school	0.91	0.60, 1.36	0.64
Received information about fruit &vegetable consumption	0.84	0.54, 1.32	0.46
Received information about milk consumption	0.98	0.63, 1.53	0.94

Reference groups: always or most of the time eat breakfast and regular 3 meals; never or rarely snaking, fruit and vegetable consumption $\geq$ 5; one or more times/day milk drinking; soft drinks $\leq$ 2/day; never eat fast food; high fat food less than one time; low quality diet never eat or less than one time/day; always, most of the time and sometimes bring food from home; never and rarely purchase food from school; never and rarely eating during TV watching; yes they received information about fruit, vegetable and milk consumption. OR, odds ratio; 95% CI, 95% confidence interval.

Table 5 Physical activity predictors of excess weight ($n = 501$)

Predictor	OR	95% CI	*P*-value
Past 7 days level of activity	0.71	0.42, 1.22	0.22
Usual week physical activity	1.26	0.73, 2.17	0.39
Past 7 days muscle strength	0.96	0.55, 1.66	0.88
Sedentary lifestyle	0.78	0.54, 1.13	0.19
Past days walked or biked to school	0.75	0.38, 1.46	0.39
Walked time to school	1.26	0.85, 1.88	0.25
Most common travel way to school	0.91	0.45, 1.82	0.79
Number of physical education class	0.87	0.58, 1.30	0.50
Taught importance of physical activity	1.00	0.66, 1.00	0.99
Received information about opportunity for physical education in community	1.07	0.71, 1.62	0.72

Reference groups: past 7 days physical activity, usual week activity and past 7 days muscle strength $\geq$ 5; sedentary lifestyle $\leq$ 2 h/day; past 7 days walked or biked to school $\geq$ 3 days; time walked to school $\geq$ 30 min; most common travel way to school walking; number of physical education class $\geq$ 2 days/semester; yes for received information on importance of physical activity and opportunity of physical education at your community. OR, odds ratio; 95% CI, 95% confidence interval.

Final prediction model

This exploratory study aimed to identify the least number of variables that could predict excess weight, and the variables that were found to be significant in the subsets analysis were combined to test one final parsimonious model. Six variables out of eight were statistically significant predictors of excess weight (Table 6): (i) family size—adolescents of families with $\leq$ 6 members compared with those with > 6 members (OR = 1.59, 95% CI: 1.08, 2.43; $P > 0.02$); (ii) presence of obesity in both parents (OR = 2.16, 95% CI: 1.06, 4.42; $P > 0.01$); (iii) father's level of education $\leq$ secondary (OR = 1.59, 95% CI: 1.08, 2.32; $P > 0.02$); (iv) income $\geq$ 300 JD/month (OR = 1.62, 95% CI: 0.99, 2.64; $P > 0.05$); (v) working mothers (OR = 1.96, 95% CI: 1.04, 3.70; $P > 0.04$); and (vi) adolescents who eat low quality diet $\geq$ 1 times per day (OR = 1.77, 95% CI: 1.13, 2.79; $P > 0.01$).

DISCUSSION

To our knowledge, this is the first comprehensive study in Jordan estimated such a range of predictors that covered an adequate sample of urban adolescents based on a review of the literature. This study reports that 17.5% of the adolescents were overweight (16.2% for boys and 18.8% for girls) and 9.6% were obese (12.8% for boys and 6.5% for girls. Boys (29.0%) were found to be slightly heavier than girls (25.4%), with a frequency of obesity in boys being double that in girls. Possibly boys experience less social pressure about their weight, tend to be more satisfied with their bodies, and have less negative attitudes about excess weight than adolescents girls and therefore they did not try to lose weight to the extent girls did.[20]

Table 6 Selected sociodemographic, dietary factors that predict excess weight: logistic regression analysis of eight variables ($n = 501$)

Predictor	OR	95% CI	*P*-value
Age	1.45	0.96, 2.20	0.08
Gender	0.96	0.61, 1.50	0.86
Family size	1.59	1.08, 2.43	0.02
Parents obesity	2.16	1.06, 4.42	0.00
Father level of education	1.59	1.08, 2.32	0.02
Family income	1.62	0.99, 2.64	0.05
Mother occupation	1.96	1.04, 3.70	0.04
Low quality diet	1.77	1.13, 2.79	0.01

Reference groups were: aged 15; gender male; family size ≤ 6 members; neither parents obesity; fathers level of education $\leq$ secondary; family income ≥ 300 JD/month; household mother; Low quality diet never eat or less than one time/day. OR, odds ratio; 95% CI, 95% confidence interval.

As this study was conducted in the capital of Jordan, Amman, a higher proportion of excess weight was found in our study compared with an earlier survey conducted in 2007.[11]

As five of the six predictors were family factors, it suggests that family is the primary influence of excess weight. The influence of environmental factors is likely to contribute to adolescents' exposure to a greater number of the risk factors because of rapid adoption of unhealthy Western lifestyles that tend to begin in large cities and later spread to smaller and eventually more rural regions in Jordan. Besides, the lack of activity in adolescents living in an urban region and the tendency to stay at home where an increased amount of time is being spent watching TV and less time spent in sport activities contributed to their excess weight. The current study provides evidence that excess weight is a common problem in Jordanian adolescents, but in comparison to adolescents in other Arab countries the frequency of overweight was lower than that in Qatari,[21] Bahraini[22] or the United Arab Emirates.[23] However, obesity in our study was higher than that in Saudi Arabian,[24] Qatari,[21] and Lebanese adolescents.[25]

Some studies suggest that adolescent girls were more likely to be overweight or obese than boys. In our study, the opposite trend was observed where boys tended to be more obese than girls. Moreover, the relationship between gender and excess weight was not associated with dietary factors or physical activity levels in the present study. Thus, our study is consistent with the findings by the Whitaker and Orzol,[26] who also failed to identify a gender difference in weight.

Like most other studies there are a number of limitations that call for cautious interpretation of our results. These include: (i) a cross-sectional design precluded causal claims; and (ii) measurements can be challenged by recall bias especially for dietary and physical activity behaviours. Possibly, the measures of BMI failed to distinguish between fat and fat-free mass (muscle and bone) weight, suggesting that the BMI could be exaggerate in large and muscular boys; nevertheless this study reports six important findings.

Family income was related to excess weight. This finding is consistent with other studies,[27,28] in which obesity was associated with higher family income (more than (300 JD/month). This relationship might partly reflect a combination of (i) food quantity increased in higher income families[29] and (ii) the differences in cultural and social views of body size might also vary.[30] Another explanation might be that with increasing income, families are opting to eat more convenience foods outside home, which are often higher in fat and calories and lower in fruits and vegetables.[31]

Family size was inversely related to adolescent obesity: adolescent from smaller families were more likely to have excess weight. Additionally, our result showed that two-thirds of families with ≤ 6 members have an income > 300 JD/month. However, Khader *et al*.[27] found that family size of ≤ 4 members was significantly associated with overweight. Conversely, Jabre *et al*.[25] did not find any significant association between family size and obesity.

Our study supports the finding that children of working mothers 'are a significant predictor for excess weight'.[32] A likely explanation might be that mothers who work outside home are less likely to have enough time to spend on shopping and preparing healthy meals for their families or to supervise their children's eating and exercise behaviours. Thus, their children might have more freedom in their food choices and might choose unhealthy meals more often.[33] Additionally, women who work outside the home have an increased demand for convenience food, which increases their fast food and restaurant food consumption that might contribute to the increasing adiposity of adolescents.[1] Moreover, our results showed that working mothers tended to have smaller sized families and higher

income compared with mothers who are not employed outside their home.

Our findings showed a relationship between education level of fathers and adolescent obesity. The frequency of excess weight was associated with low education level of the fathers (primary and secondary education). Our findings are in agreement to Jabre *et al*.[25] and are inconsistent with Khader *et al*..[27] It seems that better educated parents are more aware of this problem and more likely to protect their children from excess weight. This assumption confirmed by Huerta *et al*.[34] and Lamerz *et al*.[35]

This study identified that obesity in parents predicted obesity in their children, and supports the conviction that family is a key social environment in which health-related behaviours are shaped.[36] Khader *et al*.[27] found that the parent's BMI was directly related to excess weight in their adolescents aged 6–12 years in northern Jordan. This genetic–environmental link to adolescents overweight is comprising of the genetic predisposition to excessive weight passed on to the child, then coupled with role modelling behaviours that lead to excessive caloric intake or decreased activities that consume energy. What remains unknown is the relative contribution of genetics versus environment with excess weight. This question can only be answered by the use of identical twin studies where the twins were reared separately. Such work is being conducted by Bouchard Claude, whose finding states that correlation was 0.88 among monozygotic twin and 0.34 among dizygotic twin, which suggests a high heritability of BMI.[37]

Out of all measured dietary variables 'a low quality diet' (chips, candy bars and popcorns) was the only statistically significant predictor of excess weight in our study. The frequency of excess weight increased with increasing consumption of a 'low quality diet'. Several reasons might exist: first, if low quality foods are abundantly available at very low prices it can be purchased by every adolescent even those from low income families. Second, chips and candy are primarily fat- and carbohydrate-based sources of energy; therefore, adolescents who consumed such food were eating less healthy foods with high density energy. The total caloric intake from carbohydrates (4 kcal/mg) and fat (9 kcal/mg) increases total daily energy intake and resulted in an energy imbalance. These findings were consistent the previous studies,[27,38] who also failed to show a clear association between dietary habits and excess weight. It is possible that the differences in patterns of dietary intake between normal and overweight adolescents in fact are quite small, and that existing dietary assessments are not accurate enough to detect small differences. Additionally, adolescent, as a group, tends to underreport their dietary intake.[39]

The effect of exercise was also explored in this study. Our study shows that the majority of adolescents were sedentary; this lack of variability in exercise might be due to measurement or real finding. In this case the lack of variability in the level of exercise might account for the fact that none of the exercise variables predicted excess weight.

CONCLUSIONS

Based on the findings of the current study the following conclusions emerge: the sociodemographic variables and parental obesity have a greater influence on the frequency of excess weight among adolescents than dietary and physical activity practices. Seemingly straightforward, these variables result from complex interactions across a number of relevant social, economic, cultural and environmental contexts. Children in Jordan live in a society that has changed dramatically in the last three decades over which obesity epidemic has developed. Many of these changes, such as both parents working outside the home, insurgence of fast food, socioeconomic status and the presence of electronic media, often affect decision about what children eat, where they eat, how much they eat and the amount of energy they expend in school and leisure activities. These changes have been adopted as a normal way of life which might contribute to the development of childhood obesity.[12,40]Therefore, greater attention should be given to the strategy directed towards families and schools. Multidimensional intervention programmes that combine education, counselling and behavioural skill building along with environmental support need to be tested to evaluate their efficacy in controlling this emerging health problem. The prevention and treatment of obesity in school-aged adolescents require increased efforts and partnerships at all level.

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