

## MEAL INTAKE IN AN ADULT MOROCCAN POPULATION: DETERMINANTS AND IMPLICATIONS FOR WEIGHT STATUS

Imane Barakat<sup>1,2</sup>, Sanaa El-Jamal<sup>1</sup>, Hamid Chamlal<sup>1</sup>, Houda Elfane<sup>1</sup>,  
Halima Daif<sup>1</sup>, Mohammed Elayach<sup>1</sup>, Rekia Belahsen<sup>1</sup>

<sup>1</sup>Laboratory of Biotechnology, Biochemistry and Nutrition, Faculty of Sciences – Chouaib Doukkali University – El Jadida 24000, Morocco

<sup>2</sup>Higher Institute of Professions Nurses and Health Techniques of Marrakesh, Morocco

### ABSTRACT

**Background.** In recent decades, the Moroccan population has changed its dietary practices, particularly those related to meal-taking. It is about irregular meal schedules, reduced frequency and shorter time of meal-taking times, as well as a decrease in family meal-taking. All these factors are likely to influence its nutritional status.

**Objective.** The aim is to study meal-taking practices, their determinants and their implications on weight status. In this study, meal-taking practices are defined by the regularity of the schedule, the frequency and the duration of the meals as well as the family commensality.

**Material and Methods.** This work data are part of a study conducted among 507 households in the region of Rabat-Salé-Kenitra in Morocco, with a validated conceptual and methodological framework. The questionnaire was completed with one member of each household and the body mass index (BMI) was determined by an impedance meter.

**Results.** The main results indicate that the majority of the surveyed population was aged 35 years (59%), female (52%), urban (70%), with a BMI  $\geq 25$  kg/m<sup>2</sup> (51%), took usually three meals a day (89%), spent less than 90 minutes a day in meals and snacks (60%), had irregular meal schedule (69%), and usually eat at least two meals or snacks a day with family (49%). The univariate analysis showed that urban area was a factor favoring variations of meal times, the male sex was a factor favoring three meals a day, the level of higher education was a factor penalizing the daily duration of meals, and that marital status “married” was a factor favoring family commensality. In addition, variable meal times were revealed as a factor contributing to overweight/obesity, and meal times  $\geq 90$  min were revealed as a protective factor of overweight/obesity.

**Conclusion.** The study identified factors associated with meal times, frequency and duration. The results obtained will serve as a basis for the development of educational actions for a change in behavior conducive to health.

**Key words:** meal-taking schedule, meal-taking frequency, meal-taking duration, family commensality, Morocco

### INTRODUCTION

In recent decades, the Moroccan population has changed its dietary practices, particularly those related to meal-taking. It is about irregular meal schedules, reduced frequency and shorter time of meal-taking times, as well as a decrease in family meal-taking. All these factors are likely to influence its nutritional status [1, 2, 3, 4, 5]. Indeed, contrarily to the traditional pattern of three scheduled meals per day, the tendency to have meals at irregular times has been identified as major factor to the etiology of obesity [6]. Furthermore, experimental studies of different populations, have shown variable effects of changing meal-taking and snackings time patterns on lipid

profiles and carbohydrate tolerance [7]. Regularity of meal-taking is also an important criterion for dietary balance as skipping meals has a negative impact on health because of the subsequent increase in the feeling of hunger. The latter is likely to lead to compensatory, copious, and/or unbalanced meals, thereby promoting long-term weight gain and the risk of developing diabetes and cardiovascular diseases [8, 9]. Moreover, experimental studies have shown variable responses of lipid profiles and carbohydrate tolerance in relationship with changes in meal-taking and snacking patterns with respect to energy and macronutrient intake [10]. In addition, snacks, not intended to be taken regularly and that should be based on the specific needs of each individual, generally add a substantial amount of

**Corresponding author:** Prof. Rekia Belahsen, Laboratory of Biotechnology, Biochemistry and Nutrition, Faculty of Sciences - Chouaib Doukkali University - El Jadida 24000, Morocco Phone: +212 523 34 2325 / +212 664 97 1616, e-mail: b.rekia@gmail.com or rbelahsen@yahoo.com

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energy to the overall dietary intake in some populations and could therefore lead to overweight [11]. Similarly, it has also been reported that in the today's society, the contribution of snacks has been estimated to approximately 30% of daily energy intake, whose the majority consists in energy-dense and micronutrient-poor foods [12]. This may exacerbate overweight simultaneously with micronutrient deficiency. Furthermore, taking more time to consume meals has been associated with lower energy intake [13] while short meal-taking duration has been associated with higher BMI [14]. The significant reduction in meal-taking time is, among other things, due to the agro-industrial age of the food system that humanity is living [15], which promotes the consumption of fast food and commercially prepared meals. On the other hand, the food commensality, another relevant aspect related to dietary practices, consists of the communal meal-taking depending on the socio-cultural model of each society [16]. The family commensality, in particular, is defined by tradition and by social and/or religious rules where the family members are in a normative framework [17]. Family commensality has been associated with healthier eating habits [18]. Nevertheless, the way meals are generally organized in groups, has been reported to affect the size of the food portions consumed by each individual, and does not always take into account the food preferences of each person [19]. In addition, several other factors can also positively or negatively influence good meal-taking practices, including socio-demographic, socio-economic, and socio-cultural characteristics [20, 21, 22], women's work, continuous working hours, urbanization [2, 23, 24], as well as the family traditions, type and habits [23, 25, 26].

The present work aims, therefore, to study meal-taking practices, their determinants, as well as their implications for weight status in an adult Moroccan population.

## MATERIAL AND METHODS

The study of which this work is part, involved 507 households in the region of Rabat, Salé, Kenitra (RSK) in Morocco and has a validated conceptual and methodological framework [27].

### Data collection

Data were collected by a questionnaire covering socio-demographic characteristics and meal-taking practices, including time, frequency, and duration of meals, as well as family commensality. This questionnaire was filled up by one member of each household. BMI was determined by a clinically validated OMRON BF 214 impedance meter [28].

### Variables investigated

- Weight status was studied by BMI categorized into: 1)  $<25 \text{ kg/m}^2$ ; 2)  $\geq 25 \text{ kg/m}^2$ , taking into account that a BMI  $\geq 25 \text{ kg/m}^2$  indicates overweight or obesity.
- Age is categorized into 2 groups: 1) [20-34] years; 2)  $\geq 35$  years.
- Gender is categorized into: 1) Male; 2) Female.
- Education level is categorized into 2 groups based on whether participants are, or are not, college graduates: 1) Yes; 2) No.
- Marital status is categorized into 2 groups according to whether the participants are married or not: 1) Yes; 2) No (single, divorced, widowed).
- Family type is categorized as: 1) nuclear; 2) extended.
- Meal-taking schedule is categorized as: 1) Regular; 2) Variable.
- Meal-taking frequency is categorized into: 1)  $<3$  meals/day; 2) 3 meals/day. Snacking frequency is categorized into: 1)  $<3$  snacks/day; 2) 3 snacks/day. Daily meal-taking time is categorized into: 1)  $<90$  min; 2)  $\geq 90$  min.
- Family meal-taking (family commensality) is categorized as: 1)  $\leq 1$  meal-taking/day; 2)  $\geq 2$  meals/day.

### Statistical analysis

Statistical analysis was performed by SPSS software for Windows (Statistical Package for the Social Sciences) version 21. Associations between variables were investigated by logistic regression (univariate analysis), with a statistical significance level fixed at  $p < 0.05$ .

## RESULTS

### Characteristics of the studied population

Table 1 shows that 59% of the studied population is aged 35-71 years, 51% had a BMI  $\geq 25 \text{ kg/m}^2$ , 70% resided in urban areas, 52% is female, 64.5% were with lower or no education level, 65% were not married, and 62% belongs to a nuclear type family.

### Meal-taking and snacking: schedule, frequency, duration and family commensality

Figure 1 shows that the majority (69%) of the studied population eats meals and snacks at varying times. Figure 2 shows that the majority (89%) of the studied population used to have 3 meals per day, and only 4% used to have 3 snacks per day. Figure 3 shows that 60% of the studied population spends less than 90 min per day eating meals and snacks. Figure 4 shows that 49% of the studied population used to take at least two meals or snacks per day with their family.

Table 1. Characteristics of the studied population (n=507)

Characteristics	Values	CI (95%)
Age groups (years)		
[20 - 34]	210 (41%)	36.7- 45.8
[35- 71]	297 (59%)	54.2- 63.3
BMI (kg/m <sup>2</sup> )		
<25	247(49%)	44.2-52.9
≥25	260 (51%)	47.1-55.8
Area of residence		
Urban	355(70%)	66-74
Rural	152(30%)	26-33
Gender		
Male	244 (48%)	43.6-52.3
Female	263 (52%)	47.7- 56.4
High education level		
Yes	180 (35.5%)	31.2-40
Non	327 (64.5%)	60 -68.8
Marital status “married”		
Yes	177 (35%)	30.8- 39.3
No	330 (65%)	60.7 -69.2
Family type		
Nuclear	316 (62%)	58-67
Composed	191 (38%)	33-42

\*= Expressed in size (%); CI = Confidence Interval

*Factors associated with meal-taking and snacking practices*

Table 2 shows the results of the univariate analysis : the urban area was a factor favoring variable meal-taking schedule (OR =1.2; CI [1.1-1.7]; P = 0.03), and was a factor hindering three-meal-taking per day (OR =0.5; CI [0.25-0.91]; P = 0. 04), and meal-taking duration ≥ 90 min (OR =0.7; CI [0.47-0.93]; P = 0.03); male gender was a factor favoring three meals per day (OR =2.4; CI [1.36-4.47]; P = 0.03); higher education was a factor impeding meal-taking duration ≥ 90 min/d (OR =0. 4; CI [0.26-0.57]; P <0.001); age group [20 to 34 years] (OR=0.03; CI [0.01-0.05], p< 0.001), urban residence (OR=0.48; CI [0.34-0.69], p< 0.001), higher education level (OR=0.24; CI [0.16-0.35], p< 0.001), and nuclear family type (OR=0.5; CI [0.34-0.71], p< 0.001), were factors hindering family meal-taking ≥ 2 times per day, whereas “married” status (OR=7.7; CI [5.1-11.9], p< 0.001) was a promoting factor.

*Implications of meal-taking practices on weight status*

Table 3 shows that the variable meal-taking schedule (OR =1.2; CI [0.55- 1.49]; P =0.03) is a factor favoring overweight/obesity, and that the duration of meal-taking greater than or equal to 90 min (OR =0.5; CI [0.39-0.8]; P =0.002) is a protective factor.

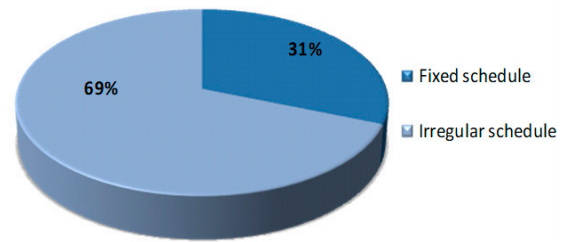


Figure 1. Distribution of the studied population according to the regularity of meal-taking and snacking schedule (n=507)

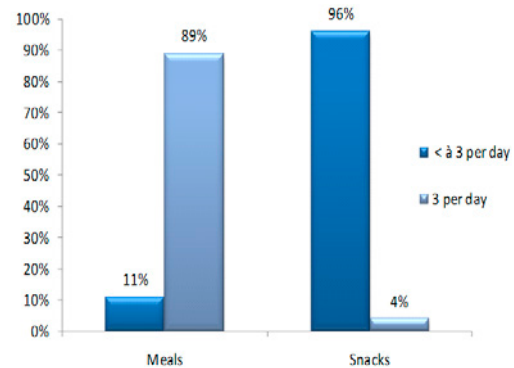


Figure 2. Distribution of the studied population according to the number of meals and snacks taken per day (n=507)

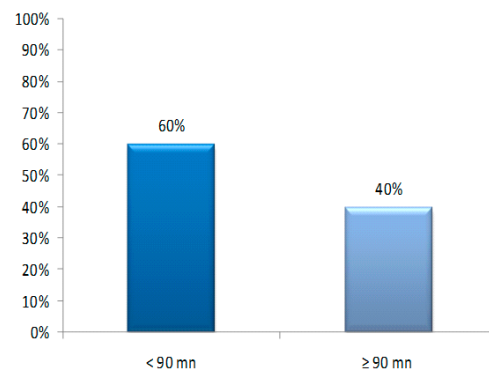


Figure 3. Distribution of the studied population according to the daily duration of meal-taking and snacking (n=507)

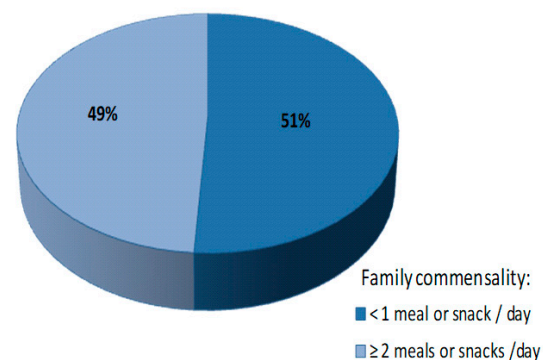


Figure 4. Distribution of the studied population according to the frequency of eating meals or snacks with their family (n=507)

Table 2. Factors associated with meal-taking and snacking practices by univariate analysis (n=507)

Characteristics	Factors associated with the variable meal schedule			Factors associated with taking 3 meals/day			Factors associated with taking 3 snacks/day			Factors associated with a daily meal time $\geq$ 90 mn			Factors associated with family meals $\geq$ 2 times/day		
	OR	IC	P	OR	IC	P	OR	IC	P	OR	IC	P	OR	IC	P
Age groups (years)															
[20 - 34]	0.9	[0.63-1.35]	0.7 NS	1.2	[0.7-2.5]	0.3 NS	2.2	[0.8 -45]	0.09 NS	0.9	[0.62-1.29]	0.5 NS	0.03	[0.01-0.06]	<0.001*
[35- 71]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Area of residence															
Urban	1.2	[1.1-1.7]	0.03*	0.5	[0.25-0.91]	0.04*	0.5	[0.2-.25]	0.1 NS	0.7	[0.47-0.97]	0.03*	0.48	[0.34-0.69]	<0.001*
Rural	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gender															
Male	0.7	[0.52-1.1]	0.1 NS	2.4	[1.36-4.47]	0.03*	1.1	[0.44-2.64]	0.8 NS	1.04	[0.73-1.48]	0.8 NS	1.05	[0.71-1.53]	0.7 NS
Female	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
High education level															
Yes	1.1	[0.75-.66]	0.5 NS	0.9	[0.54-1.7]	0.9 NS	1.2	[0.49-3.04]	0.6 NS	0.4	[0.26-0.57]	<0.001*	0.24	[0.16-0.35]	<0.001*
Non	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Marital status "married"															
Yes	0.9	[0.6-1.35]	0.6 NS	0.9	[0.53-1.65]	0.8 NS	0.4	[0.15-1.37]	0.1 NS	0.9	[0.64-1.35]	0.7 NS	7.7	[5.1-11.9]	<0.001*
No	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Family type															
Nuclear	1.1	[0.75-0.64]	0.6 NS	1.2	[0.68-2.07]	0.5 NS	3.5	[1.03-12.3]	0.4 NS	0.7	[0.35-2.7]	0.3 NS	0.5	[0.34-0.71]	<0.001*
Composed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

OR = Odds Ratio; CI = 95% Confidence Interval; \* = Significant; NS = Not Significant; Significance level p &lt; 0.05

Table 3. Meal-taking practices associated with overweight/obesity in the studied population (n=507)

Meal taking		Univariate analysis		
		OR	CI (95%)	P
Meal schedule	Fixed	-	-	-
	Variable	1.2	[0.55- 1.49]	0.03*
Meal frequency	<3/day	-	-	-
	3/day	1.02	[0.59-1.76]	0.9 NS
Snack frequency	<3/day	-	-	-
	3/day	0.5	[0.19-1.27]	0.1 NS
Duration of meals	<90 mn/day	-	-	-
	≥90 mn/day	0.5	[0.39-0.8]	<b>0.002*</b>
Family commensality	≤1 meal/day	0.9	[0.66-1.33]	0.7 NS
	≥2 meals/day	-	-	-

OR = Odds Ratio; CI = 95% Confidence Interval; \*= Significant; NS= Not Significant; Significance level  $p < 0.05$

## DISCUSSION

The data of this study are part of the context of sustainability of the Moroccan food model which is of the Mediterranean type. The latter has experienced a shift from the traditional model to a modern one [21]. This change is linked to several factors, drivers of several changes that have accompanied the global transition in several countries, including Morocco. These consist of economic, demographic, urbanization, epidemiological and nutritional changes, with an effect on lifestyle, including the level of physical activity and diet, the alteration of which has led to excessive weight/obesity and associated health problems. These changes also include those in dietary practices, the subject of this article. Among the practices examined in the present study, a meal-taking habits of three meals a day is revealed to be the rule in the majority of the studied population. This result is consistent with that reported in a previous study conducted in El Jadida, another province of Morocco [29]. In this context, while the recommended number of meal-taking per day is three, it is usually limited to two meals, because of the establishment of a continuous work schedule [1]. In fact, snacking could be useful depending on the specific needs of each individual, while taking into account the time interval between two main meals [30]. Only a minority of this study population has the habit of eating 3 snacks per day. In addition, the majority of the studied population is revealed to eat meals at variable times. This result is not consistent with data obtained in Europeans as reported by the Belgian food consumption survey, showing that the majority of the populations of 10-64 years old, have fixed meal-taking times [31]. The present data also report that the majority of the study population devotes less than 90 min per day to meal-taking. In contrast, a study conducted in France in 2010, has reported that

feeding was on 2 hours 22' per day on average, and that meal-taking was considered as enjoyable as reading or listening to music [32]. Furthermore, the present survey results, indicated that most of the population has meals or snacks with their family at least twice a day. Moroccan culture and traditions, as in other Mediterranean countries [33], may be contributing factors. Indeed, it has been reported that culture generally determines the forms of food intake and conviviality [34]. In contrast to the effect of culture, it has been shown that civilization in general and the modernization of the food act, in particular, can lead to a preference for food individualism [1] rather than family commensality.

Analysis of the factors associated with meal-taking practices has shown that the urban area is a factor favoring variable meal-taking times. The study conducted in Belgium on food consumption, has shown that female gender and higher education level were the factors that favore regular meal-taking [31]. In the present study, male gender was found to be a factor promoting the intake of three meals a day, whereas urban area was a hindering factor. Another study showed that the reduced number of meal-taking (<3/day) is favored by the urban area and young age (18 to 29 years) factors [35]. The present study also demonstrated that urban area and higher education level are factors hindering meal-taking duration. Another study revealed that older people spend more time than younger people on meal-taking [32]. Concerning the family commensality, the statistical analysis of this study data revealed that young age, and residing in urban areas hindered family meal-taking. In the similar way, previous studies have shown that urban areas [1] and young age are associated with modern eating behaviors [33], including meal-taking outside the home [36], which can negatively impact family commensality. From

the analysis conducted here, higher education level is revealed also that as factor hindering family meal-taking. This could be related to the fact that higher education level has induced living conditions and scientific, academic and/or professional commitments that are not always in favor of family meal-taking in this study population. On the other hand, belonging to a nuclear family is also revealed as a factor hindering meal-taking in the family. It should be noted that in Morocco, unlike a nuclear family, the extended family [37], includes not only parents and their children but also grandparents and other family members, which is likely to provide a favorable environment for family meals. This study has also shown that “married” status is a factor that favors meal-taking in the family. This could perhaps be linked to the stability generally offered by this status, on the one hand, and on the other hand, to the engagement of married people in various activities registered in family norms [19], including commensality. Certainly, although often considered important for social communion, order, health, and well-being, family commensality is in decline. Indeed, despite these multiple benefits, each member of the family with their own social activities, finds it necessary to make efforts not to miss this daily ritual [38].

Regarding the association of meal-taking practices with BMI, the analysis has revealed that irregular meal-taking schedule is a factor favoring overweight and obesity. Indeed, irregular meal-taking schedules has been reported to disrupt the circadian system, lead to adverse health consequences, and have an obesogenic effect [7]. In addition, the few available cross-sectional and prospective cohort studies, have also reported that irregular meal-taking is associated with a higher risk of metabolic syndrome and cardiometabolic risk factors, including BMI and blood pressure [39]. Likewise, other randomized controlled intervention studies have shown that regular meal-taking for 2 weeks compared with an irregular meal-taking pattern, led to a beneficial impact on cardiometabolic risk factors such as lower insulin peak and lower LDL cholesterol, both in lean and obese women [39]. In addition, an increased risk of obesity, diabetes, and cardiovascular diseases has been attributed to unusual meal-taking schedules and circadian rhythm disruption [40]. Further, analysis of this study data pointed out that a long meal-taking time is protective against overweight and obesity. This could be explained by the fact that subjects who spend less time consuming their meals often resort to fast food away from home. Indeed, overweight and obesity have been shown to be enhanced by the consumption of fast food, usually high in fat and low in dietary fibers [41]. In addition, a rapid rate of food intake has been correlated with a dysfunction of the regulatory action of leptin on appetite and body mass gain [42].

The net action of leptin is to inhibit appetite, stimulate thermogenesis, enhance fatty acid oxidation, decrease glucose and reduce body weight [43].

## CONCLUSION

The current study identified the factors associated with meal-taking schedule, frequency, duration, and family commensality, as well as their implications for weight status. The results obtained in this study could serve as a basis for the development of educational actions towards a change in health-promoting behavior for the study population, and for further quantitative and qualitative research on meal-taking practices as a whole.

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### Conflicts of interest

*The authors declare that they have no conflicts of interest.*

### Author contributions

*The authors participated in all phases of this research, including its conception, execution, interpretation of its results, and writing of the manuscript.*

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