



Food and Nutrition  
Administration



Kuwait Ministry of Health

---

# KUWAIT NUTRITIONAL SURVEILLANCE SYSTEM

## 2020

---

**Annual National Report**

*December 2022*

**List of Participants:**

**Dr. Nawal Alqaoud:** Director of the Food and Nutrition Administration

**Fahima Al-Anazi:** Head of Nutrition Research Department, KNSS staff management

**Monica Subhakaran:** Nutritionist, KNSS data management

**Dr. Doggui Radhouene:** Department of family medicine, Université de Sherbrooke, Canada.  
Centre de formation médicale du Nouveau – Brunswick, Moncton, Canada

**Dr. Ayoub Al-Jawaldeh:** Regional Office for the Eastern Mediterranean (EMRO), World Health Organisation (WHO), Cairo, Egypt.

**Data collection and entry:**

|                     |                     |                   |
|---------------------|---------------------|-------------------|
| Ahlam Al-Shamri     | Ebtisam Mohammad    | Nouf Al Zafairi   |
| Amna Al-Azmi        | Ebtisam Al-Enezi    | Seham Al-Mutairi  |
| Amna Jamal          | Eida Al-Husaini     | Tahani Al-Mutairi |
| Asma Al-Shameri     | Fatin Bo-Hamad      |                   |
| Bandari Al Mutairi  | Alanood Naser       |                   |
| Bashayir Al-Mutairi | AlHanouf Al Zafairi |                   |
| Badrya Murshed      | Halima Abbas        |                   |
| Dalal Al-Enezi      | Amal Al Baluchi     |                   |

# TABLE OF CONTENTS

|   |     |
|---|-----|
| Executive Summary.....  | vi  |
| List of Tables.....   | ix  |
| List of Figures.....  | xi  |
| List of Abbreviations.....  | xii |
| 1. Introduction .....   | 1   |
| 2. Methodology.....   | 2   |
| 2.1. Kuwait nutrition surveillance system.....  | 2   |
| 2.2. Study population and sampling procedure.....                                     | 3   |
| <b>2.2.1.</b> Children under five years .....   | 3   |
| <b>2.2.2.</b> Adults .....  | 3   |
| 2.3. Data collection among children under two years.....                              | 4   |
| <b>2.3.1.</b> Indicators of child feeding .....                                       | 4   |
| <b>2.3.2.</b> Anthropometric measurements.....  | 6   |
| <b>2.3.3.</b> Socio-demographic characteristics and other sample characteristics..... | 6   |
| 2.4. Data collected among children under five years .....                             | 6   |
| <b>2.4.1.</b> Indicators of children feeding .....                                    | 6   |
| <b>2.4.2.</b> Screen Time.....  | 7   |
| <b>2.4.3.</b> Anthropometric data .....   | 7   |
| 2.5. Data collection among adults.....  | 8   |
| 2.6. Anthropometric data.....   | 8   |
| <b>2.6.1.</b> Corpulence related measurements.....                                    | 8   |
| <b>2.6.2.</b> Weight management strategy.....   | 8   |

|  |    |
|--|----|
| 2.7. Clinical data .....   | 8  |
| <b>2.7.1.</b> Self-reported diabetes .....   | 8  |
| <b>2.7.2.</b> Hypertension .....   | 9  |
| <b>2.7.3.</b> Hypercholesterolemia .....   | 9  |
| 2.8. Lifestyle factors.....  | 9  |
| <b>2.8.1.</b> Dietary intake.....  | 9  |
| <b>2.8.2.</b> Physical activity.....   | 10 |
| <b>2.8.3.</b> Smoking.....   | 10 |
| <b>2.8.4.</b> Socioeconomic and demographic factors .....  | 10 |
| 2.9. Statistical analysis.....   | 10 |
| 3. Results of the survey conducted among children under two years .....  | 12 |
| 3.1. Sample characteristics of children under two years .....  | 12 |
| 3.2. Feeding indicators overall sample of children under two years.....  | 12 |
| <b>3.2.1.</b> Prevalence of children breastfed within the first hour of birth and association with cofactors ..... | 15 |
| <b>3.2.2.</b> Exclusive breastfeeding and association with cofactors .....   | 17 |
| <b>3.2.3.</b> Mixed milk feeding among children under six months and association with cofactors.....               | 18 |
| <b>3.2.4.</b> Continued breastfeeding among children aged 12 – 23 months and association with cofactors.....       | 18 |
| 3.3. Complementary feeding indicators of children under 2 years .....  | 19 |
| 3.4. Nutritional status of children under two years.....   | 20 |
| <b>3.4.1.</b> Prevalence of overweight and obesity .....   | 20 |

|               |  |    |
|---------------|--|----|
| <b>3.4.2.</b> | Individual-level risk factors associated with overweight and obesity.....  | 22 |
| <b>3.4.3.</b> | Prevalence of wasting and stunting .....                                   | 24 |
| 4.            | Results of the survey conducted among children under five years.....       | 27 |
| 4.1.          | Sample characteristics of children under five years.....                   | 27 |
| 4.2.          | Dietary consumption and eating behaviours among children under five years. | 28 |
| 4.3.          | Time of screen use .....   | 28 |
| 4.4.          | Prevalence and risk factors of overweight and obesity.....                 | 28 |
| 4.5.          | Prevalence of wasting and stunting .....                                   | 31 |
| 5.            | Results of the survey conducted among adults.....                          | 33 |
| 5.1.          | Sample characteristics .....   | 33 |
| 5.2.          | Self-reported diabetes.....  | 34 |
| <b>5.2.1.</b> | Prevalence and association with cofactors .....                            | 34 |
| <b>5.2.2.</b> | Risk factors of diabetes among adults .....                                | 34 |
| 5.3.          | Self-reported hypertension.....  | 36 |
| <b>5.3.1.</b> | Prevalence of Self-reported hypertension and association with cofactors... | 36 |
| <b>5.3.2.</b> | Risk factors of self-reported hypertension among adults.....               | 37 |
| 5.4.          | Self-reported hypercholesterolemia.....                                    | 38 |
| <b>5.4.1.</b> | Prevalence and association with cofactors .....                            | 38 |
| <b>5.4.2.</b> | Risk factors of hypercholesterolemia among adults.....                     | 38 |
| 5.5.          | Lifestyle factors.....   | 40 |
| <b>5.5.1.</b> | Dietary intake.....  | 40 |
| <b>5.5.2.</b> | Physical activity .....  | 40 |
| <b>5.5.3.</b> | Smoking.....   | 40 |

|               |  |    |
|---------------|--|----|
| 5.6.          | Anthropometric status.....   | 41 |
| <b>5.6.1.</b> | Overweight and obesity prevalence.....   | 41 |
| <b>5.6.2.</b> | Relationship between subject-level overweight and obesity status and living environment, socio-demographic factors, and lifestyle factors..... | 41 |
| 5.7.          | Bodyweight perception and management .....   | 43 |
| <b>5.7.1.</b> | Bodyweight perception.....   | 43 |
| <b>5.7.2.</b> | Bodyweight perception by gender, education level, occupational status, and anthropometric status.....  | 43 |
| <b>5.7.3.</b> | Relationship between subject-level misperception of body weight and sex .....  | 45 |
| <b>5.7.4.</b> | Strategies for bodyweight management by body weight perception .....   | 45 |
| 6.            | Conclusion .....   | 46 |
| 7.            | References .....   | 47 |

# Executive summary

## Introduction

The *specific objectives* of the following report were: i) to examine the eating behaviours among the various age classes (e.g., consumption of fruit and vegetables, breastfeeding related practises, and dietary food diversity (only among children under five years)) and associated risk factors; ii) to assess prevalence of overweight and obesity and associated risk factors among age classes; iii) to investigate the prevalence of chronic non-communicable diseases (self-reported diabetes, self-reported hypertension, and self-reported hypercholesterolemia) and associated risk factors; iv) to assess lifestyle factors (i.e., smoking and physical activity practise) among adults.

## Methods

The surveillance was conducted among children under two years, under five years, and adults. No sampling plan was established. The children (0 – 5 years) were recruited from eight health centres in all the six Kuwait governorates at the time of their vaccination. Adult participants were selected from attendants to various places, including – but not limited to – attendants to health centres because of minor disease conditions, attendants to pre-employment examination and the Public Authority for Social Security.

## Results

### *Children under two years*

- **Feeding indicators:**
  - Breastfeeding within the first hour of birth (EIBF) was common in nearly 60% of children.
  - Exclusive breastfeeding among children (0 – 5 months), mixed milk feeding under six months (MixMF), and continued breastfeeding among children aged 12 – 23 months (CBF) were very low as they tend to be common only among 10% or less. Only half of the children aged between 6 and 8 months were found to consume solid or semi-solid food

(ISSSF), reaching the minimum dietary diversity of 5 groups at least (MDD) and consuming egg/flesh food at the age of 6 to 23 months.

- The prevalence of breastfed children during the first hour after birth was significantly different across governorates ( $P < 0.0001$ ).

- The prevalence of sugar-sweetened beverages consumption during the day before the survey among children (6-23 months) reached 54%. Finally, a quarter of children do not consume any fruit or vegetable (ZfV indicator) during the assessment.

- **Overweight and obesity**

- The prevalence of overweight (including obesity) was 11.9 [95% CI: 10.4 – 13.7].

- The overall prevalence of obesity was 3.4% [95% CI: 2.6 – 4.5].

### *Children under five years*

- **Feeding indicators:**

- Overall, 23.2% [95% CI: 20.3 – 26.3] of children were identified as breakfast skippers.

- About 61.7% of the children consumed at least four food groups.

- The weekly frequency of carbonated drinks consumption was consumed one time per week on average.

- Finally, the non-fresh drinks were consumed four times per week on average.

### **Overweight and obesity**

- About 11.3% [95%: 9.3 – 13.8] of children were found to be overweight.

### *School Age Children (5years to < 19 years)*

- Due to the pandemic (COVID-19) the schools were closed. Hence no data was collected.

### *Adults*

- **Chronic diseases:**

- Overall, 17.3% [95% CI: 15.1 – 19.6] of adults self-reported having diabetes.

- The risk of being affected by diabetes was higher among those having secondary schooling level (OR=1.8 [95% CI: 1,1 – 2.8]) and obese (OR=2.5 [95% CI: 1.4 – 4.7]).
- About 16.9 [95% CI: 14.8 – 19.2] of adults reported being affected by hypertension.
- The age increase by one year was associated with an increased odd of self-reported hypertension by 9%.
- Being overweight (adjusted OR=2.0, 95% CI [1.01 – 4.1]; vs. thin or normal) or obese (adjusted OR=3.4, 95% CI [1.7 – 6.7]) was associated with the risk of being hypertensive.
- Overall, 12.5% [95% CI [10.6-14.5] of adults self-reported having hypercholesterolemia.
- The age increase appeared to be a significant risk factor (OR= 1.08 [95% CI:1.06 – 1.11]). Being obese was positively associated with hypercholesterolemia (OR= 2.1, 95% CI [1.1 – 4.2]).

### **Lifestyle factors**

- Only 8.4% [95% CI: 6.9 – 10.3] and 6.2% [95% CI: 4.9 – 7.8] of adults reported adequate fruit and vegetable consumption levels, respectively.
- Overall, 45.6% [95% CI: 42.7 – 48.5] of the participants reported having moderate (less than five days in a week) to high (5 days or more in a week) levels of physical activity. Of them, 17.7% [95% CI: 15.5 – 20.1] practised physical activity for five days and more in a week.

### **Overweight and obesity**

- Overall, 74.6% [95% CI: 71.9 – 77.1] were found to be overweight (including obesity).

**Conclusion:** The nutrition transition has impacted the population health. The health authorities are urged to intervene in order to halt the progression of chronic non-communicable diseases and to reduce the impact of health risk factors.

## LIST OF TABLES

|  |    |
|--|----|
| <b>Table 1.</b> WHO infant and young child feeding indicators targeted by the Kuwait Nutritional Surveillance System [14] .....  | 5  |
| <b>Table 2.</b> Characteristics of children (0–23 months, n=1467) recruited in the Kuwait Nutritional Surveillance System in 2020 .....  | 13 |
| <b>Table 3.</b> Children (0–23 months, n=1467) birth weight in 2020 .....  | 14 |
| <b>Table 4.</b> Adjusted prevalence of children born in the last 24 months breastfed within one hour of birth, by various demographic, birth characteristics, and mother status regarding visiting private health center during pregnancy..... | 16 |
| <b>Table 5.</b> Prevalence of exclusive breastfeeding among children under six months, by various demographic, birth characteristics, and mother status regarding visiting a private health center during pregnancy. ....                      | 17 |
| <b>Table 6.</b> Prevalence of mixed milk feeding among children under six months, by various demographic, birth characteristics, and mother visiting a private health center during pregnancy.....   | 18 |
| <b>Table 7.</b> Prevalence of continued breastfeeding among children aged 12-23 months, by various demographic, birth characteristics and mother visiting private health center during the pregnancy status.....                               | 19 |
| <b>Table 8.</b> Prevalence of complementary feeding indicators among children aged 6 to 23 months, by sex, residential area and mother status regarding consultation of private/public health centers during the pregnancy.....                | 21 |
| <b>Table 9.</b> Logistic regression for the association of socio-demographic and birth characteristics with overweight among children under two years (n=1341) .....   | 23 |
| <b>Table 10.</b> Characteristics of children (2–5 years, n=783) recruited in the Kuwait Nutritional Surveillance System in 2020.....   | 27 |

|   |    |
|---|----|
| <b>Table 11.</b> Breakfast skipping, minimum dietary diversity, carbonated drinks, and non-fresh drinks consumption among children under 5 years by socio-demographic characteristics ..... | 29 |
| <b>Table 12.</b> Time screen use among children under five years.....   | 30 |
| <b>Table 13.</b> Logistic regression for the association of lifestyle factors, eating behaviours, and socio-demographic characteristics with overweight.....                                | 30 |
| <b>Table 14.</b> Prevalence of wasting and stunting among children under five years by socio-demographic characteristics .....  | 31 |
| <b>Table 15.</b> Socio-demographic characteristics and place of residence of Kuwaiti adults in 2020 (n = 1156). .....   | 33 |
| <b>Table 16.</b> Association between self-reported diabetes with the place of residence, socio-demographic factors, anthropometry, and lifestyle factors .....                              | 35 |
| <b>Table 17.</b> Association between self-reported hypertension with the place of residence, socio-demographic factors, anthropometry, and lifestyle factors .....                          | 37 |
| <b>Table 18.</b> Association between self-reported hypercholesterolemia and place of residence, socio-demographic factors, anthropometry, and lifestyle factors.....                        | 39 |
| <b>Table 19.</b> Logistic regression for the association of overweight and obesity with socio-demographic and anthropometric characteristics.....   | 42 |
| <b>Table 20.</b> Association of bodyweight perception with socioeconomic and anthropometric factors.....  | 44 |
| <b>Table 21.</b> Logistic regression for the association of body weight misperception with sex .....  | 45 |
| <b>Table 22.</b> Weight control behaviours by weight perception.....  | 46 |

## LIST OF FIGURES

|  |    |
|--|----|
| <b>Figure 1.</b> Prevalence of standard WHO infant and young child feeding indicators in children under two years..... | 14 |
| <b>Figure 2.</b> Prevalence of overweight by socio-demographic characteristics among children under 2 years.....       | 20 |
| <b>Figure 3.</b> Prevalence of obesity by socio-demographic characteristics among children under 2 years.....          | 22 |
| <b>Figure 4.</b> Prevalence of wasting by socio-demographic characteristics among children under 2 years.....          | 24 |
| <b>Figure 5.</b> Prevalence of stunting by socio-demographic characteristics among children under 2 years.....         | 25 |
| <b>Figure 6.</b> Self-reported diabetes prevalence among Kuwaiti adults (19 years and more).<br>.....                  | 34 |
| <b>Figure 7.</b> Self-reported hypertension prevalence among Kuwaiti adults (19 years and more).<br>.....              | 36 |
| <b>Figure 8.</b> Self-reported hypercholesterolemia prevalence among Kuwaiti adults (19 years and more).....           | 38 |
| <b>Figure 9.</b> Weight perception of Kuwaiti Adults.....  | 43 |

## LIST OF ABBREVIATIONS

---

| <b>Abbreviation</b> | <b>Meaning</b>   |
|---------------------|--|
| BMI                 | Body Mass Index  |
| CBF                 | Continued breastfeeding among children aged 12 – 23 months |
| EBF                 | Exclusive breastfeeding under six months                   |
| EFF                 | Egg and/or flesh food consumption 6–23 months              |
| EIBF                | Early Initiation of breastfeeding                          |
| ISSSF               | Introduction of solid, semi-solid or soft foods 6–8 months |
| MDD                 | Minimum dietary diversity 6 – 23 months                    |
| MixMF               | Mixed milk feeding under six months                        |
| OR                  | Odds Ratio   |
| UFC                 | Unhealthy food consumption 6 – 23 months                   |
| WHO                 | World Health Organization                                  |
| ZVF                 | Zero vegetable or fruit consumption 6 – 23 months          |
| 95% CI              | 95% Confidence Interval                                    |

---

## 1. Introduction

The data collected through the nutrition surveillance system is at the most importance for policy development, nutrition research, identifying high-risk groups, and monitoring trends. The information generated allows the assessment of the evolution of the population's nutritional status and identifies population groups at high risk of health impairment. Based on the provided information, intervention programs are then developed. The efficacy of these interventional programs is assessed, and then nutrition policies are developed or reworked. Finally, the relationship between exposure variables (dietary intake, level of physical activity and other lifestyle factors) and health status is examined.

The State of Kuwait established a nutrition surveillance system for more than 20 years. This nutritional surveillance system is one of the most efficient in the Eastern Mediterranean region. The data collected through this program has been used to understand the nutrition transition phenomenon occurring in the country. The nutrition transition is characterized by a shift in the dietary patterns and lifestyle factors of the population. In this regard, high energy intake and overconsumption of macronutrients have been reported by *Zaghloul et al.* [1]; indeed, half of the Kuwaiti children and one-third of adults have exceeded the recommended daily energy intake. The recommendations for macronutrients such as protein and carbohydrates have been exceeded by at least 78%. Sodium consumption exceeded the tolerable upper limit nearly among all age classes [1, 2]. The nutrition transition phenomenon was concomitant to the economic growth in Kuwait [2]. The country's development is mirrored by the human development index increase from 0.705 in 1990 to 0.806 in 2019 [3]. Consistently, food availability improved but with more access to fast food and other obesogenic foods [1]. Also, a spread of the sedentary lifestyle and lowered physical activity level occurred [4]. A recent study showed that half of the adults only have moderate physical activity levels while only 10% reached high levels [5]. *Hashem et al.* showed that 3.4% of adolescents

spent  $\geq 60$  minutes per day of moderate to vigorous physical activity, and a fifth met the screen time guidelines [4]. A more recent study showed that more than 20% of children under five years use a screen (TV or computer) for more than two hours per day [6].

Nowadays, the country is classified by the World Health Organization (WHO) in '*advanced nutrition category*' like Bahrain, Qatar, and Saudi Arabia [7]. Indeed, several published papers [6, 8-11] highlighted the alarming rate of overweight and obesity among the population as well as the progress of chronic diseases (e.g., diabetes, hypertension) [12, 13]. According to the WHO, non-communicable chronic diseases are estimated to account for 72% of all deaths, where 41% are accountable to cardiovascular diseases, 15% for cancers and 3% for diabetes.

The Food and Nutrition Administration (FNA), part of the Ministry of Health, is the main governmental body in charge of monitoring the population's nutritional status through the Kuwait nutrition surveillance system.

The *general objective* of this report's main aim is to update the nutritional and health indicators among the Kuwaiti population through nationally conducted surveys.

The *specific objectives* were: i) to examine the eating behaviours among the various age classes (e.g., consumption of fruit and vegetables, breastfeeding-related practises, and dietary food diversity (only among children under five years)) and associated risk factors; ii) to assess prevalence of overweight and obesity and associated risk factors among age classes; iii) to investigate the prevalence of chronic non-communicable diseases (self-reported diabetes, self-reported hypertension, and self-reported hypercholesterolemia) and associated risk factors; iv) to assess lifestyle factors (i.e., smoking and physical activity practise) among adults.

## **2. Methodology**

### **2.1. Kuwait nutrition surveillance system**

The State of Kuwait established nutrition surveillance system in 1995 and it has been running successfully for more than 20 years. The Kuwait nutrition surveillance system

(KNSS) has been designated to collect, analyze, and disseminate surveillance data to guide public health policy and action. The data are collected only among Kuwaiti citizens using standardized data collection forms through personal interviews conducted by trained field agents. The overall objective of KNSS is to provide regular and updated information on the nutritional status of the Kuwaiti population (children and adults) and the influencing factors. Because the national representative survey is conducted yearly, the KNSS allows assessing nutritional status trends over time.

## **2.2. Study population and sampling procedure**

### **2.2.1. *Children under five years***

Children under five years (aged 0 – 23 months and 24 – 60 months) were recruited from eight health centres in all the six Kuwait governorates at the time of their vaccination from March to November 2020. The free vaccination in Kuwait and the high coverage (almost 100%) allow the generation and access to a representative sample of Kuwaiti children [9]. The KNSS accounts for a pre-established list of designated health centres sentinel sites for nutritional surveillance in all governorates. No sampling method was used as every mother or child guardian attending the vaccination centres was invited to participate in data collection, and only less than 2% refused to participate. For the purpose of this repeated national cross-sectional study among pre-school children, the interview was conducted with mothers or children's guardian

### **2.2.2. *Adults***

Participants were selected from attendants to various places, including – but not limited to – attendants to health centres because of minor disease conditions, attendants to pre-employment examination, the Public Authority for Social Security and university students. Formal letters from Food and Nutrition Administration were sent to the relevant institutions seeking their permission and asking for the arrangements for data collection.

## 2.3. Data collection among children under two years

### 2.3.1. Indicators of child feeding

Several data were collected among children under two years covering breastfeeding practises, solid and liquid food consumption, and other eating behaviours (Table 1).

- *Liquid consumption*

Questions were addressed to collect data for the first time of child breastfed, and during the day before the survey, the nature of the food (including breastfeeding, formula and food drinks) consumed the day before. A question detailing different drinks consumption (water, milk (including powder or animal milk), juice (any type), soup/clear broth, yoghurt/leban, thin porridge, honey, Dates syrup/sugar with water, herbs, and any other drink) was addressed to mothers.

- *Solid food*

Two sets of questions were addressed to mothers in order to collect data on solid food consumption by their children. The first question was '*Did your child eat any solid or semi-solid food yesterday, both during the day and night?*' (if yes mother were asked to report how many times the solid food was eaten). Secondly, a specific question was used to collect data specific 13 food items consumption (Porridge, bread, rice, noodles, or other food made from grains; Pumpkin, carrots, sweet potato, that are yellow or orange; White potato and mushroom truffles(Faga'a); Dark green leafy vegetables; Mango, papaya, watermelon, apricot; Other fruits and vegetables; liver, kidneys or hearts; Eat meat or chicken; eggs; fish or seafood; any food made from beans, peas, lentils, nuts, or seeds; Cheese, yogurt, or other milk products; any oil, fats, or butter, or foods made with any of these; Any sugary foods such as chocolates, sweets, candies, pastries, cakes). Answer options were 'yes', 'no', or 'I don't know'. The 'I don't know' option was conducted as a missing value.

**Table 1.** WHO infant and young child feeding indicators targeted by the Kuwait Nutritional Surveillance System [14]

| Indicator  | Definition   |
|--|--|
| <b>Breastfeeding indicators</b>                                    |  |
| Early Initiation of breastfeeding (EIBF)                           | Percentage of children born in the last 24 months who were put to the breast within one hour of birth  |
| Exclusive breastfeeding under six months (EBF)                     | Percentage of infants 0–5 months of age who were fed exclusively with breast milk during the previous day  |
| Mixed milk feeding under six months (MixMF)                        | Percentage of infants 0–5 months of age who were fed formula and/or animal milk in addition to breast milk during the previous day   |
| Continued breastfeeding among children aged 12 – 23 months (CBF)   | Percentage of children 12–23 months of age who were fed breast milk during the previous day.   |
| <b>Complementary feeding indicators</b>                            |  |
| Introduction of solid, semi-solid or soft foods 6–8 months (ISSSF) | Percentage of infants 6–8 months of age who consumed solid, semi-solid, or soft foods during the previous day  |
| Minimum dietary diversity 6 – 23 months (MDD)                      | Percentage of children 6–23 months of age who consumed foods and beverages from at least five out of eight defined food groups during the previous day.  |
| Egg and/or flesh food consumption 6–23 months (EFF)                | Percentage of children 6–23 months of age who consumed egg and/or flesh food during the previous day   |
| Sweet beverage consumption 6 – 23 months (SwB)                     | Percentage of children 6–23 months of age who consumed a sweet beverage during the previous day.   |
| Unhealthy food consumption 6 – 23 months (UFC)                     | Percentage of children 6–23 months of age who consumed selected sentinel unhealthy foods during the previous day.  |
| Zero vegetable or fruit consumption 6 – 23 months (ZVF)            | Percentage of children 6–23 months of age who did not consume any vegetables or fruits during the previous day   |
| <b>Other indicators</b>  |  |
| Infant feeding area graphs   | <p>The standard recommended area graph classifies IYC into one of six categories:</p> <ul style="list-style-type: none"> <li>• exclusively breastfed;</li> <li>• breastfed and plain water only;</li> <li>• breastfed and non-milk liquids (no solid or semi-solid foods and no animal milk-based liquids or infant formula);</li> <li>• breastfed and animal milk or formula (no solid or semi-solid foods);</li> <li>• breastfed and solid or semi-solid foods; or</li> <li>• not breastfed.</li> </ul> <p>The percentage of children entering each of these categories is calculated by two-month age groups and graphed for infants under six months of age.</p> |

<sup>1-</sup> food groups are: breast milk; grains, roots, tubers, and plantains; pulses (beans, peas, lentils), nuts and seeds; dairy products (milk, infant formula, yogurt, cheese); flesh foods (meat, fish, poultry, organ meats); eggs; vitamin-A rich fruits and vegetables; and other fruits and vegetables. <sup>2-</sup> includes juice, yoghurt (including *leban*: of the note the used question does not distinguish clearly between drinkable yogurt or semi solid format), honey, and dates syrup/sugar with water.

### **2.3.2. Anthropometric measurements**

The weight of children was determined by using a digital scale to the nearest 100 g. The height was measured to the nearest 0.1 cm using a length board. The weighing scales were calibrated regularly using a well-known weight set. All measurements were carried out by trained dieticians [15]. The WHO growth standard was applied, as follows: overweight was defined as body mass index (BMI)-for-age  $\geq +2$  z and obesity  $\geq +3$  z, respectively [16].

### **2.3.3. Socio-demographic characteristics and other sample characteristics**

Data on mother education level, visit public health center during the pregnancy, visit of private health center during the pregnancy, place where the children were born (private or governmental hospital), type of delivery, birth weight, duration of pregnancy, advice, received on breastfeeding during the stay in the hospital.

## **2.4. Data collected among children under five years**

### **2.4.1. Indicators of children feeding**

- *Dietary diversity score*

The same questionnaire used for children under two years was replicated for those under five years. The dietary diversity score (DDS) was calculated in the same with the exclusion of the breastfeeding including a total of seven food groups according to WHO guidance: (1) cereals, roots and tubers; (2) legumes and nuts; (3) milk and its derivatives; (4) meat products (meat, poultry, and fish); (5) eggs; (6) vitamin A-rich fruits and vegetables (leafy green vegetables, yellow fruits and vegetables); and (7) other fruits and vegetables [13]. The dietary diversity score (DDS) was defined as the number of food groups consumed by the child the previous day. A DDS of four is considered the minimum DDS [17].

- *Eating behaviours*

One question was addressed to each child's mother or guardian: '*when does your child have breakfast?*' The mother was asked to select one of the following responses: before 7

am, 7–9 am, 9–11 am and after 11 am. Participants having their breakfast after 11 am were identified as skippers. The weekly frequency of sugary and sweetened beverages consumption was assessed through two questions: *'How many times per week does your child consume carbonated drinks?'* and *'How many times per week does your child consume non-fresh drinks (industrialized) juices?'*. For these questions, response options included the following: *'None'*, *'one per week'*, *'two times per week'*, *'three times per week'*, *'four times per week'*, *'five times per week'*, and *'six times per week and more'*.

#### **2.4.2. Screen Time**

Four questions were used to assess screen time *'How long does the child watch television during the weekend?'*, *'How long does the child watch television daily?'*, *'How long does the child play computer games during the weekend?'*, and *'How long does the child play computer games daily?'*. Response options included *'less than 2 h'*, *'2–3 h'* and *'more than 3 h'* for these questions.

#### **2.4.3. Anthropometric data**

Data was collected by dietitians. Standing height was measured to the nearest 0.1 cm using an electronic stadiometer (SECA model 220); weight was measured to the nearest 0.1 kg on a calibrated scale (SECA Alpha, medical scales and measurement systems, Hamburg, Germany). Concerning children <5.09, the WHO growth standard was applied, as follows: overweight was defined as body mass index (BMI)-for-age > +2 z and obesity > +3 z, respectively [18]. For children aged ≥5.09 years, we used WHO of 2007, as follows: overweight was defined as BMI-for-age > +1 z score and obesity as > +2 z score [19]. BMI-for-age z-scores were calculated using WHO Anthro Plus software [20].

## **2.5. Data collection among adults**

### **2.6. Anthropometric data**

#### *2.6.1. Corpulence related measurements*

Trained dieticians collected all anthropometric data and measurements. Standing height was measured to the nearest 0.1 cm using an electronic stadiometer (SECA model 220); weight was measured to the nearest 0.1 kg on a calibrated scale (SECA Alpha, medical scales and measurement systems, Hamburg, Germany). For participants aged below 19 years, we used the WHO standard defined in 2007 [19]: overweight was defined as body mass index (BMI)-for-age  $> +1$  z score, obesity as  $> +2$  z score and thinness as  $< -2$  z score. For participants aged 20 years and above, we adopted this international categorization of BMI, overweight. The WHO Anthro Plus software 3.1. was used for the calculation of body mass index-for-age z-score [20].

#### *2.6.2. Weight management strategy*

Each participant was asked to reply to those items '*Do you think your body weight is above normal?*'. Response options were: '*yes to a great extent*', '*yes a little*', '*no, normal*', '*no, underweight*', and '*I don't know*'. Also, participants were asked to document their strategy for managing (maintain or lose) their weight during the last three months: they were asked to select one of the following approaches, namely diet, exercise, herbs and herbal mixtures, medication, or surgery (any time).

## **2.7. Clinical data**

### *2.7.1. Self-reported diabetes*

Data on diabetes was collected by addressing the following question to each participant '*Do you have any increase in blood glucose?*'. Along with the addressed question, when subjects reported using glucose-lowering medication, they were automatically identified as having diabetes.

### 2.7.2. Hypertension

Data on hypertension was collected by addressing the following question to each participant '*Do you have hypertension?*'. Along with the addressed question, when subjects reported using blood pressure medication, they were automatically identified as hypertensive.

### 2.7.3. Hypercholesterolemia

Data on hypercholesterolemia was collected by addressing the following question to each participant '*Do you have any increase in cholesterol level?*'. Along with the addressed question, when subjects reported using cholesterol-lowering medication, they were automatically identified as having hypercholesterolemia.

## 2.8. Lifestyle factors

### 2.8.1. Dietary intake

Among each participants data on fruit dietary intake was collected using five questions as follow: '*How many days in a week do you eat fruit except dates?*', '*How many servings of fruit do you eat per day?*', '*How many days in a week do you eat fresh or cooked vegetable?*', '*How many servings of vegetable do you eat per day?*', and '*Did you eat or drink something beside water during last 12 hours?*'.

The daily average of fruit and vegetable consumption was estimated using the following formula:

$$\text{Average daily intake of fruit and vegetable} = \frac{(\text{number of days in a week} \times \text{daily serving intake})}{7}$$

Participants reported consuming five or more vegetable servings per day, and four or more fruit servings per day were identified as compliers with international recommendations.

### **2.8.2. Physical activity**

The following question was addressed to the participants '*Do you practice any physical activity currently?*' and were asked to select one of the three suggestions '*Yes, often (more than 5 days a week)*', '*Yes, occasionally (less than 5 days a week)*', and '*none*'.

### **2.8.3. Smoking**

Smoking practises related data was collected by asking participants '*Do you smoke cigarettes or hookah (shisha) nowadays?*'. Response options included '*cigarettes only*', '*cigarettes and hookah*', '*Only Hookah*', and '*No smoking*'.

### **2.8.4. Socioeconomic and demographic factors**

Trained dieticians collected all data and measures. Data on the level of education, occupation, and participants' living region were collected using a questionnaire during the survey day.

## **2.9. Statistical analysis**

Stata 16 (Stata Corporation, College Station, TX, USA, 2019) was used for data management and statistical analyses. Results were presented as estimates (percentage or mean) and 0.95 confidence intervals. The logistic regression was used to assess crude and adjusted associations of binary outcome variables (e.g., overweight, obesity and feeding indicators) with exposure variables. In general, crude prevalences were presented except for chronic diseases (hypertension, diabetes and hypercholesterolemia). Linear regression was used to examine the cofactors associated with continuous outcomes (e.g., frequency of carbonated beverage consumption). The distribution of outcome variables over subgroups of socio-demographic characteristics was assessed using the Chi-squared test unless the expected value of one cell of the contingency table was less than five, so the Fisher's test was used as an alternative to test the association. Regression coefficients were compared over subgroups using the Wald test.

## **Survey conducted among children under two years**

### *Results*

### **3. Results of the survey conducted among children under two years**

#### **3.1. Sample characteristics of children under two years**

Table 2 and Table 3 show the characteristics of the children under two years included in the following study. Data were collected on 1467 Kuwaiti children (0–23 months), of whom 48.8 % were girls. The mother was the main source of information on the child (92.0%). Most Kuwaiti mothers had been to antenatal care clinics during the pregnancy. On average, the mother's pregnancy duration fell slightly below nine months, and the type of delivery was equally distributed between vaginal and caesarean. It is worth mentioning that most mothers reported receiving advice to breastfeed their children during their pregnancy in health facilities. The mean value of birth weight was  $3359.6 \pm 47.2$  g. Finally, 22.5% of the children were born with low birth weight (<2500 g).

#### **3.2. Feeding indicators overall sample of children under two years**

Figure 1 shows the standard infant and young child feeding indicators as recommended by WHO [14]. Breastfeeding within the first hour of birth (EIBF) was common in nearly 60% of children. Exclusive breastfeeding among children (0 – 5 months), mixed milk feeding under six months (MixMF), and continued breastfeeding among children aged 12 – 23 months (CBF) were very low as they tend to be common only among 10% or less. Only half of the children aged between 6 and 8 months were found to consume solid or semi-solid food (ISSSF), reaching the minimum dietary diversity (MDD) of five groups and consuming egg/flesh food at the age of 6 to 23 months. The prevalence of sweetened sugar-sweetened beverages consumption during the day before the survey among children (6-23 months) reached 54%. Finally, a quarter of children do not consume any fruit or vegetable (ZFV indicator) during the assessment.

**Table 2.** Characteristics of children (0–23 months, n=1467) recruited in the Kuwait Nutritional Surveillance System in 2020

| <b>Characteristic</b>   | <b>n</b> | <b>% or mean</b> |
|---|----------|------------------|
| <b>Source of information</b>  |          |                  |
| Mothers   | 1349     | 92.0             |
| Fathers   | 84       | 5.7              |
| Others  | 34       | 2.3              |
| <b>Sex</b>  |          |                  |
| Female  | 751      | 48.8             |
| Male  | 716      | 51.2             |
| <b>Age (months)</b>   |          |                  |
| 0 – 5   | 620      | 42.3             |
| 6 – 8   | 314      | 21.4             |
| 9 – 23  | 530      | 36.3             |
| <b>Whether mother visited public health facility during pregnancy</b>   |          |                  |
| Yes   | 643      | 47.5             |
| No  | 712      | 52.6             |
| <b>Whether mother visited private health facility during pregnancy</b>  |          |                  |
| Yes   | 1211     | 89.4             |
| No  | 143      | 10.6             |
| <b>Type of delivery</b>   |          |                  |
| Vaginal   | 779      | 53.2             |
| Caesarean   | 686      | 46.8             |
| <b>Birth weight (g)</b>   |          |                  |
| Very low birth weight (<1500 g)   | 24       | 1.6              |
| Low birth weight (<2500 g)  | 306      | 20.9             |
| Normal birth weight (≥2500 g)   | 1027     | 70.3             |
| High birth weight (≥4000 g)   | 105      | 7.2              |
| <b>Any illness during the last three months</b>                         |          |                  |
| Yes   | 471      | 32.2             |
| No  | 991      | 67.8             |
| <b>Duration of pregnancy</b>  | 1467     | 8.9 ± 0.01       |
| <b>Received advice on breastfeeding during the stay in the hospital</b> |          |                  |
| Yes   | 1260     | 92.8             |
| No  | 98       | 7.2              |

**Table 3.** Children (0–23 months, n=1467) birth weight in 2020

| Characteristic                  | n    | % or mean |
|---------------------------------|------|-----------|
| <b>Birth weight (g)</b>         |      |           |
| Very low birth weight (<1500 g) | 24   | 1.6       |
| Low birth weight (<2500 g)      | 306  | 20.9      |
| Normal birth weight (≥2500 g)   | 1027 | 70.3      |
| High birth weight (≥4000 g)     | 105  | 7.2       |

Breastfeeding indicators

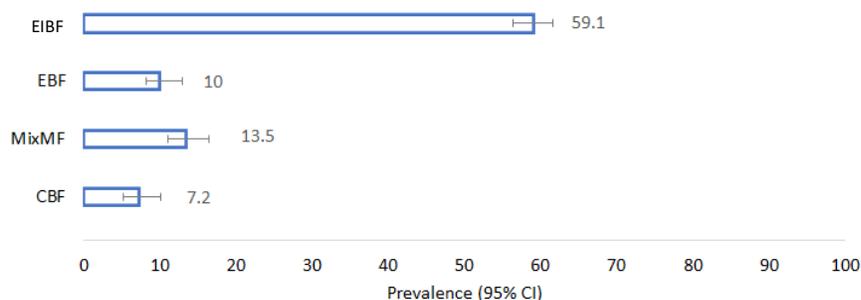


Figure 1- A

Complementary feeding indicators

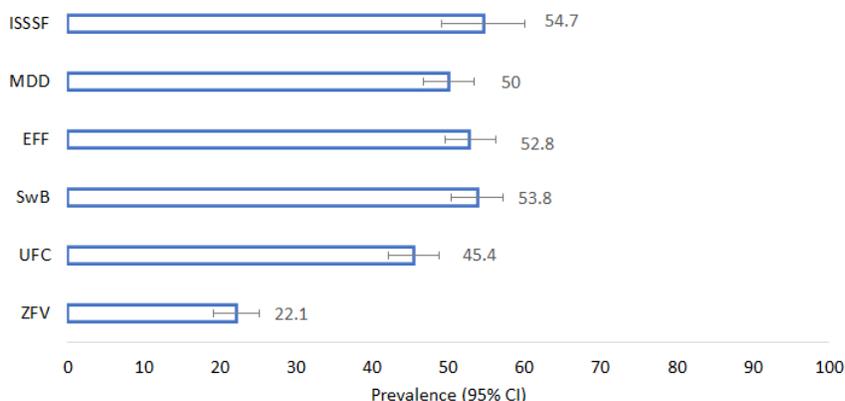


Figure 1- B

**Figure 1.** Prevalence of standard WHO infant and young child feeding indicators in children under two years.

*Figure caption:* Early Initiation of breastfeeding (EIBF); Exclusive breastfeeding under six months (EBF); Mixed milk feeding under six months (MixMF); Continued breastfeeding among children aged 12 – 23 months (CBF) Introduction of solid, semi-solid or soft foods 6–8 months (ISSSF); Minimum dietary diversity 6 – 23 months (MDD); Egg and/or flesh food consumption 6–23 months (EFF); Sweet beverage consumption 6 – 23 months (SwB); Unhealthy food consumption 6 – 23 months (UFC); Zero vegetable or fruit consumption 6 – 23 months (ZVF). Bars are indicative of the 95% confidence interval (CI).

### 3.2.1. *Prevalence of children breastfed within the first hour of birth and association with cofactors*

Table 4 shows the adjusted prevalences of children that were breastfed within the first hour after birth in the different subgroups. The prevalence was significantly different across governorates ( $P < 0.0001$ ), with the highest prevalence reported in the Capital (90.9%). The prevalence declined dramatically in *Ahmadi governorate* (3.1%). Receiving advice on breastfeeding and the duration of pregnancy were positively associated with higher prevalence of breastfeeding.

**Table 4.** Adjusted prevalence of children born in the last 24 months breastfed within one hour of birth, by various demographic, birth characteristics, and mother status regarding visiting private health center during pregnancy.

| Characteristic   | n    | Adjusted percentage <sup>1</sup> | 95%         | p <sup>2</sup> |
|--|------|----------------------------------|-------------|----------------|
| Sex  |      |                                  |             |                |
| Boys   | 716  | 59.6                             | 56.8 – 62.5 | 0.75           |
| Girls  | 751  | 59.3                             | 56.1 – 62.4 |                |
| Age (months)   |      |                                  |             |                |
| 0 – 5  | 620  | 59.3                             | 56.1 – 62.4 | 0.67           |
| 6 – 8  | 314  | 62.1                             | 57.8 – 66.6 |                |
| 9 – 23   | 533  | 57.2                             | 53.9 – 60.6 |                |
| Governorate  |      |                                  |             |                |
| Capital  | 220  | 90.9                             | 87.2 – 94.6 | <0.0001        |
| Hawali   | 345  | 70.1                             | 65.0 – 75.2 |                |
| Farwania   | 244  | 29.6                             | 23.9 – 35.2 |                |
| Ahmadi   | 171  | 3.1                              | 0.5 – 5.7   |                |
| Jahra  | 235  | 85.9                             | 81.6 – 90.2 |                |
| Mubarak Al Kabeer  | 252  | 60.5                             | 54.5 – 66.5 |                |
| Received advice on breastfeeding during the stay in the hospital |      |                                  |             |                |
| Yes  | 1260 | 62.0                             | 59.8 – 64.1 | <0.0001        |
| No   | 98   | 22.9                             | 15.3 – 30.5 |                |
| Duration of pregnancy (months)                                   |      |                                  |             |                |
| 9  | 1368 | 61.3                             | 59.1 – 63.3 | <0.0001        |
| Less than 9  | 99   | 30.7                             | 22.4 – 39.0 |                |
| Visiting private health center during pregnancy                  |      |                                  |             |                |
| Yes  | 1211 | 58.1                             | 55.9 - 60.4 | 0.066          |
| No   | 143  | 67.8                             | 62.1 – 73.5 |                |

<sup>1</sup>- adjusted prevalence for sex, age, governorate, mother status for receiving advice regarding breastfeeding their children in the hospital, duration of the pregnancy, and visiting a private health center. <sup>2</sup>- P-value for children breastfeeding during the first hour after birth x cofactor issued by Wald test.

### 3.2.2. Exclusive breastfeeding and association with cofactors

The total prevalence of children under six months that received exclusive breastfeeding the day before the survey, was only 10.0 [95% CI: 7.9 – 12.6] (Figure 1). This prevalence was very heterogenic across governorates ( $p < 0.0001$ ). The highest prevalence (Table 5) was found in the Capital, while the lowest one was in the *Ahmadi* governorate. Exclusive breastfeeding practice was slightly better when the mother received advice on breastfeeding during her stay in the hospital ( $p = 0.046$ ).

**Table 5.** Prevalence of exclusive breastfeeding among children under six months, by various demographic, birth characteristics, and mother status regarding visiting a private health center during pregnancy.

| Characteristic   | n  | Percentage | 95%         | P <sup>1</sup> |
|--|----|------------|-------------|----------------|
| Sex  |    |            |             |                |
| Boys   | 34 | 9.8        | 6.9 – 13.9  | 0.49           |
| Girls  | 33 | 10.2       | 7.3 – 14.2  |                |
| Governorate  |    |            |             | <0.0001        |
| Capital  | 28 | 32.9       | 23.8 – 43.6 |                |
| Hawali   | 21 | 16.2       | 10.8 – 23.5 |                |
| Farwania   | 3  | 2.8        | 1.0 – 8.3   |                |
| Ahmadi   | 1  | 1.6        | 1.0 – 10.6  |                |
| Jahra  | 3  | 2.8        | 1.0 – 8.5   |                |
| Mubarak Al Kabeer  | 6  | 4.5        | 2.1 – 9.8   |                |
| Receive of advice on breastfeeding during the stay in the hospital |    |            |             | 0.046          |
| Yes  | 57 | 10.7       | 8.3 – 13.5  |                |
| No   | 2  | 4.6        | 1.1 – 16.4  |                |
| Duration of pregnancy (months)                                     |    |            |             | 0.29           |
| 9  | 60 | 10.5       | 8.2 – 13.4  |                |
| Less than 9  | 2  | 4.4        | 1.1 – 16.2  |                |
| Visiting private health center during pregnancy                    |    |            |             | 0.32           |
| Yes  | 55 | 10.4       | 8.0 – 13.2  |                |
| No   | 4  | 7.2        | 2.7 – 17.9  |                |

<sup>1</sup> P value for exclusive breastfeeding children under 6 months) x cofactor issued by Fischer's test.

### 3.2.3. Mixed milk feeding among children under six months and association with cofactors

Mixed milk feeding prevailed among 13.5% [95% CI: 11.1 – 16.5] of children. Prevalences among subgroups were reported in Table 6.

**Table 6.** Prevalence of mixed milk feeding among children under six months, by various demographic, birth characteristics, and mother visiting a private health center during pregnancy.

| Characteristic   | n  | Percentage | 95%         | P <sup>1</sup> |
|--|----|------------|-------------|----------------|
| Sex  |    |            |             |                |
| Boys   | 45 | 14.6       | 11.1 – 19.0 | 0.41           |
| Girls  | 37 | 12.3       | 9.0 – 16.5  |                |
| Governorate  |    |            |             | <0.0001        |
| Capital  | 15 | 19.7       | 12.2 – 30.2 |                |
| Hawali   | 21 | 16.4       | 10.9 – 23.8 |                |
| Farwania   | 6  | 5.6        | 2.5 – 11.9  |                |
| Ahmadi   | 13 | 20.9       | 12.5 – 32.8 |                |
| Jahra  | 3  | 2.8        | 1.0 – 8.5   |                |
| Mubarak Al Kabeer  | 24 | 18.3       | 12.5 – 25.8 |                |
| Receive of advice on breastfeeding during the stay in the hospital |    |            |             | 0.043          |
| Yes  | 77 | 14.4       | 11.7 – 17.6 |                |
| No   | 2  | 4.5        | 1.1 – 16.4  |                |
| Duration of pregnancy (months)                                     |    |            |             | -              |
| 9  | -  | 0.0        | -           |                |
| Less than 9  | 62 | 11.7       | 9.2 – 14.8  |                |
| Visiting private health center during pregnancy                    |    |            |             | 0.99           |
| Yes  | 72 | 13.8       | 11.1 – 17.0 |                |
| No   | 7  | 12.7       | 6.1 – 24.4  |                |

<sup>1</sup> P value for mixed milk feeding children under 6 months) x cofactor issued by Fischer's test.

### 3.2.4. Continued breastfeeding among children aged 12 – 23 months and association with cofactors

Tables 7 shows that the highest prevalence was reported in the *Hawali* governorate, among those whose mothers received advice regarding breastfeeding in the hospital.

**Table 7.** Prevalence of continued breastfeeding among children aged 12-23 months, by various demographic, birth characteristics and mother visiting private health center during the pregnancy status

| Characteristic   | n  | Percentage | 95%        | P <sup>1</sup> |
|--|----|------------|------------|----------------|
| Sex  |    |            |            |                |
| Boys   | 19 | 8.4        | 5.4 – 12.8 | 0.37           |
| Girls  | 14 | 6.1        | 3.6 – 10.1 |                |
| Governorate  |    |            |            |                |
| Capital  | 7  | 9.4        | 4.5 – 18.5 | 0.008          |
| Hawali   | 14 | 12.1       | 7.3 – 19.5 |                |
| Farwania   | 1  | 1.3        | 0.2 – 9.1  |                |
| Ahmadi   | 2  | 3.2        | 0.8 – 12.0 |                |
| Jahra  | 1  | 1.7        | 0.2 – 10.9 |                |
| Mubarak Al Kabeer  | 8  | 11.5       | 5.8 – 21.5 |                |
| Receive of advice on breastfeeding during the stay in the hospital |    |            |            |                |
| Yes  | 29 | 7.5        | 5.2 – 10.6 | -              |
| No   | -  | 0          | -          | -              |
| Duration of pregnancy (months)                                     |    |            |            |                |
| 9  | 32 | 7.4        | 5.3 – 10.4 | 0.46           |
| Less than 9  | 1  | 4.1        | 0.6 – 24.4 |                |
| Visiting private health center during pregnancy                    |    |            |            |                |
| Yes  | 26 | 6.9        | 4.7 – 10.1 | 0.56           |
| No   | 3  | 7.3        | 2.3 – 20.4 |                |

<sup>1</sup> P value for continued breastfeeding among children 12-23months) x cofactor issued by Fischer's test.

### 3.3. Complementary feeding indicators of children under 2 years

Table 8 shows that all indicators had similar distribution by sex. Roughly half of the children meet the requirement for each feeding indicator except for fruit and vegetable consumption, where only a quarter of them did not consume them the day before the survey. A huge variation was depicted ( $p$  values < 0.0001 for all indicators) according to the living governorate. The indicators were found to be better among children living in the Capital, *Farwania*, and *Mubarak Al Kabeer*, respectively. Visiting a private hospital was associated with a higher prevalence of 'introduction of solid, semi-solid or soft foods 6–8

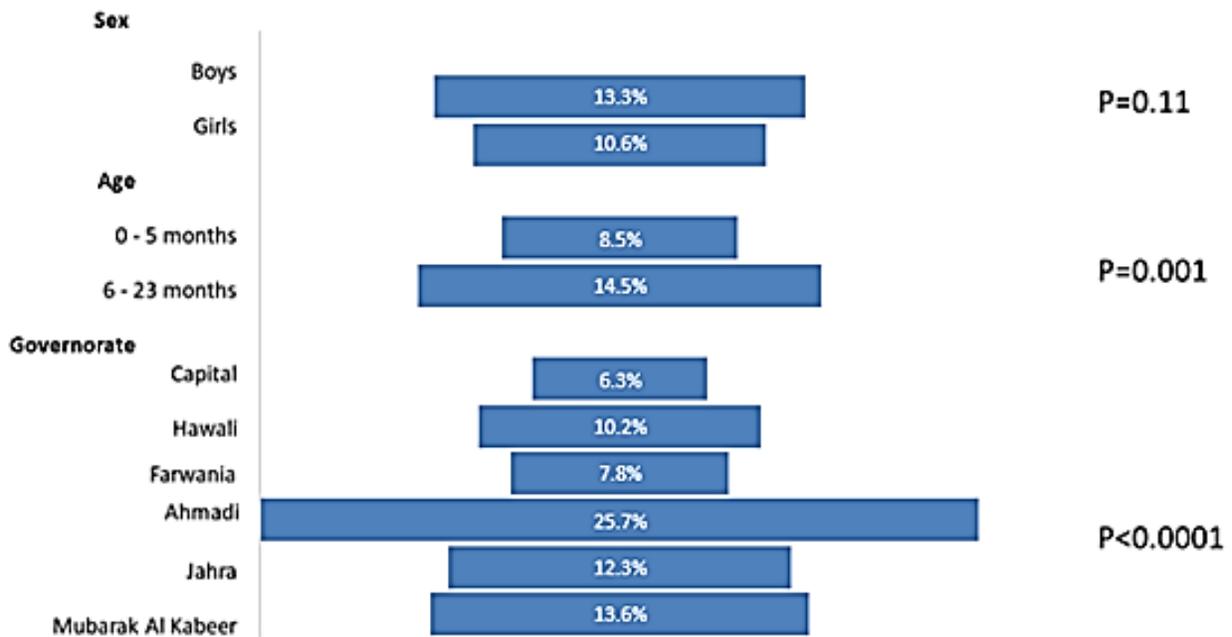
months' ( $p=0.012$ ). Visiting a public health facility or hospital during the pregnancy was associated with better 'minimum dietary diversity' ( $p<0.001$ ) and 'introduction of solid, semi-solid or soft foods 6–8 months' indicators ( $p=0.036$ ).

### 3.4. Nutritional status of children under two years

#### 3.4.1. Prevalence of overweight and obesity

- *Overweight (including obesity)*

Overall sample, the prevalence of overweight was 11.9% [95% CI: 10.4 – 13.7]. According to Figure 2, the overweight prevalence tends to increase by age and to vary significantly by governorate ( $p<0.0001$ ). Surprisingly the overweight prevalence in the *Ahmadi* governorate was two-fold higher than the national average, while the lowest prevalence was reported in children living in the Capital.



**Figure 2.** Prevalence of overweight by socio-demographic characteristics among children under 2 years. *Figure caption:* P value for overweight x cofactor issued by Chi-squared test.

**Table 8.** Prevalence of complementary feeding indicators among children aged 6 to 23 months, by sex, residential area and mother status regarding consultation of private/public health centers during the pregnancy.

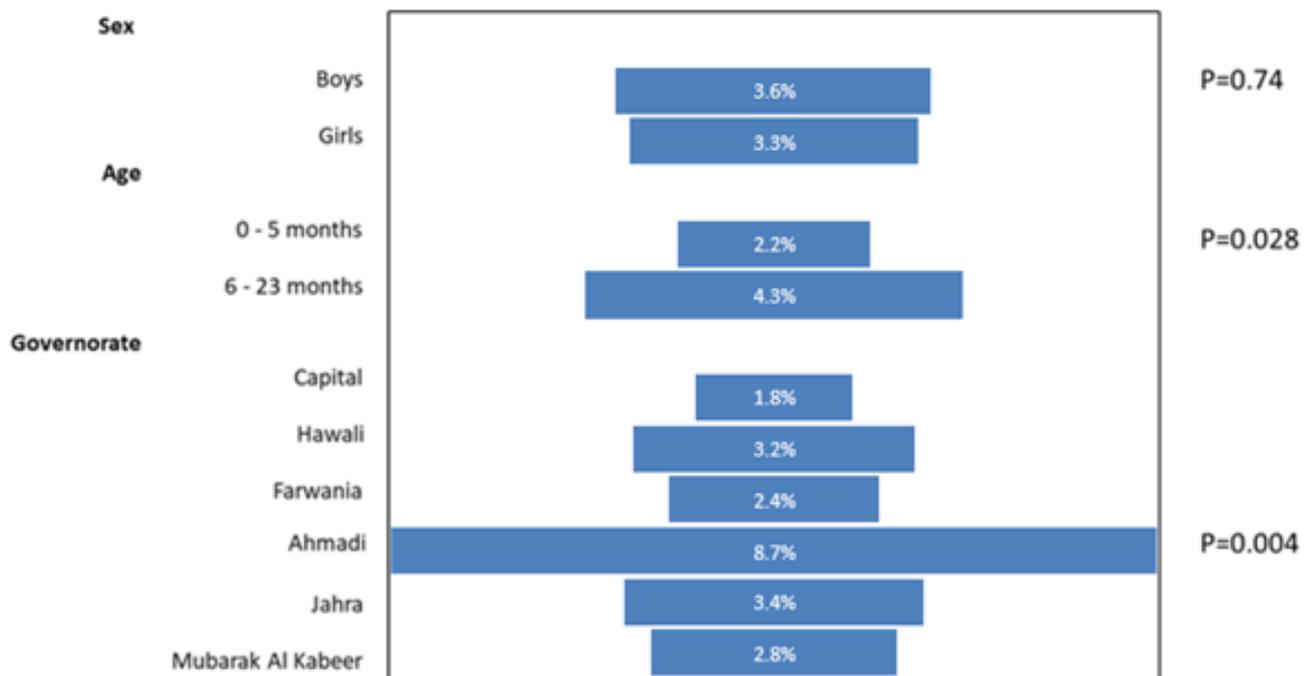
|   | ISSSF <sup>1</sup> |                     | MDD <sup>2</sup> |                     | EFF <sup>3</sup> |                     | SwB <sup>4</sup> |                     | UFC <sup>5</sup> |                     | ZVF <sup>6</sup> |                     |
|---|--------------------|---------------------|------------------|---------------------|------------------|---------------------|------------------|---------------------|------------------|---------------------|------------------|---------------------|
|   | %                  | 95% CI <sup>7</sup> | %                | 95% CI <sup>7</sup> | %                | 95% CI <sup>7</sup> | %                | 95% CI <sup>7</sup> | %                | 95% CI <sup>7</sup> | %                | 95% CI <sup>7</sup> |
| Sex   |                    |                     |                  |                     |                  |                     |                  |                     |                  |                     |                  |                     |
| Boys  | 55.7               | 47.3 – 63.7         | 51.0             | 46.1 – 55.8         | 53.6             | 48.7 – 58.5         | 56.5             | 51.6 – 61.2         | 43.0             | 38.2 – 47.9         | 20.9             | 17.0 – 25.5         |
| Girls   | 53.8               | 46.2 – 61.1         | 48.9             | 44.3 – 52.6         | 52.1             | 47.4 – 56.7         | 51.5             | 46.8 – 56.0         | 47.6             | 42.9 – 52.3         | 23.1             | 19.2 – 27.5         |
| Governorate                                     |                    |                     |                  |                     |                  |                     |                  |                     |                  |                     |                  |                     |
| Capital   | 83.6               | 70.5 – 91.6         | 74.8             | 66.8 – 81.4         | 68.9             | 60.0 – 75.7         | 61.4             | 53.0 – 69.3         | 73.7             | 65.5 – 80.4         | 5.5              | 2.7 – 11.1          |
| Hawali  | -                  |                     | 22.3             | 17.2 – 28.3         | 42.5             | 35.9 – 49.3         | 31.1             | 25.3 – 37.6         | 23.6             | 18.3 – 29.9         | 30.2             | 24.1 – 37.0         |
| Farwania  | 91.5               | 79.3 – 96.7         | 50.3             | 42.0 – 58.7         | 53.2             | 44.9 – 61.4         | 40.8             | 32.9 – 49.3         | 20.4             | 14.4 – 28.0         | 23.8             | 17.2 – 31.9         |
| Ahmadi  | 20.0               | 9.8 – 36.4          | 54.1             | 44.7 – 63.2         | 49.5             | 40.2 – 58.8         | 65.1             | 55.7 – 73.0         | 53.2             | 43.8 – 62.3         | 37.3             | 28.4 – 47.2         |
| Jahra   | 76.4               | 63.3 – 85.7         | 61.5             | 52.9 – 69.5         | 56.9             | 48.2 – 65.1         | 80.7             | 73.0 – 86.6         | 61.2             | 52.6 – 69.2         | 17.8             | 11.4 – 26.9         |
| Mubarak Al Kabeer                               | 92.5               | 79.1 – 97.5         | 54.5             | 45.6 – 63.1         | 51.7             | 42.7 – 60.4         | 61.1             | 52.1 – 69.4         | 56.3             | 47.3 – 64.9         | 13.9             | 8.3 – 22.1          |
| Visiting private health center during pregnancy |                    |                     |                  |                     |                  |                     |                  |                     |                  |                     |                  |                     |
| Yes   | 58.9               | 52.7 – 64.9         | 53.5             | 49.7 – 57.2         | 53.1             | 49.3 – 56.9         | 54.1             | 50.4 – 57.8         | 46.3             | 42.6 – 50.1         | 20.3             | 17.3 – 23.8         |
| No  | 37.1               | 22.9 – 54.5         | 46.6             | 36.4 – 57.0         | 48.8             | 38.6 – 59.0         | 61.3             | 50.8 – 70.9         | 50.5             | 40.2 – 60.9         | 28.6             | 19.5 – 39.6         |
| Visiting public health center during pregnancy  |                    |                     |                  |                     |                  |                     |                  |                     |                  |                     |                  |                     |
| Yes   | 74.5               | 70.3 – 78.8         | 43.5             | 38.7 – 48.4         | 44.3             | 39.4 – 49.1         | 56.5             | 51.5 – 61.2         | 49.3             | 44.4 – 54.2         | 22.5             | 18.5 – 27.2         |
| No  | 59.8               | 54.7 – 64.7         | 51.2             | 46.1 – 56.3         | 50.5             | 45.4 – 55.6         | 53.3             | 48.3 – 58.4         | 44.2             | 39.2 – 49.4         | 19.8             | 15.8 – 24.6         |

<sup>1</sup>- Introduction of solid, semisolid or soft foods 6–8 months (ISSSF); <sup>2</sup>-Minimum dietary diversity 6 – 23 months (MDD); <sup>3</sup>-Egg and/or flesh food consumption 6–23 months (EFF); <sup>4</sup>-Sweet beverage consumption 6 – 23 months (SwB); <sup>5</sup>-Unhealthy food consumption 6 – 23 months (UFC); <sup>6</sup>-Zero vegetable or fruit consumption 6 – 23 months (ZVF); <sup>7</sup>-Bars are indicative of 95% confidence interval (CI).

Of note, the prevalence of overweight (without the obesity) was 8.4 [95 % CI: 7.1 – 10.0].

- *Obesity*

Overall, the national prevalence of obesity was 3.4% [95% CI: 2.6 – 4.5]. Figure 3 shows the distribution of obesity by socio-demographic characteristics. Obesity was evenly distributed by gender but more frequently observed among older children ( $p=0.028$ ). Also, obesity appeared to be more frequent among children living in *Ahmadi* governorate.



**Figure 3.** Prevalence of obesity by socio-demographic characteristics among children under 2 years.

Figure caption: P-value for obesity x cofactor issued by Chi-squared test.

### 3.4.2. Individual-level risk factors associated with overweight and obesity

Table 9 shows that age and birth weight were positively associated with overweight. Children living in *Ahmadi*, *Jahra* and *Mubarak Al Kabeer* were more at risk of being overweight. Early initiation of breastfeeding (first hour after birth) is not predicted overweight.

**Table 9.** Logistic regression for the association of socio-demographic and birth characteristics with overweight among children under two years (n=1341)

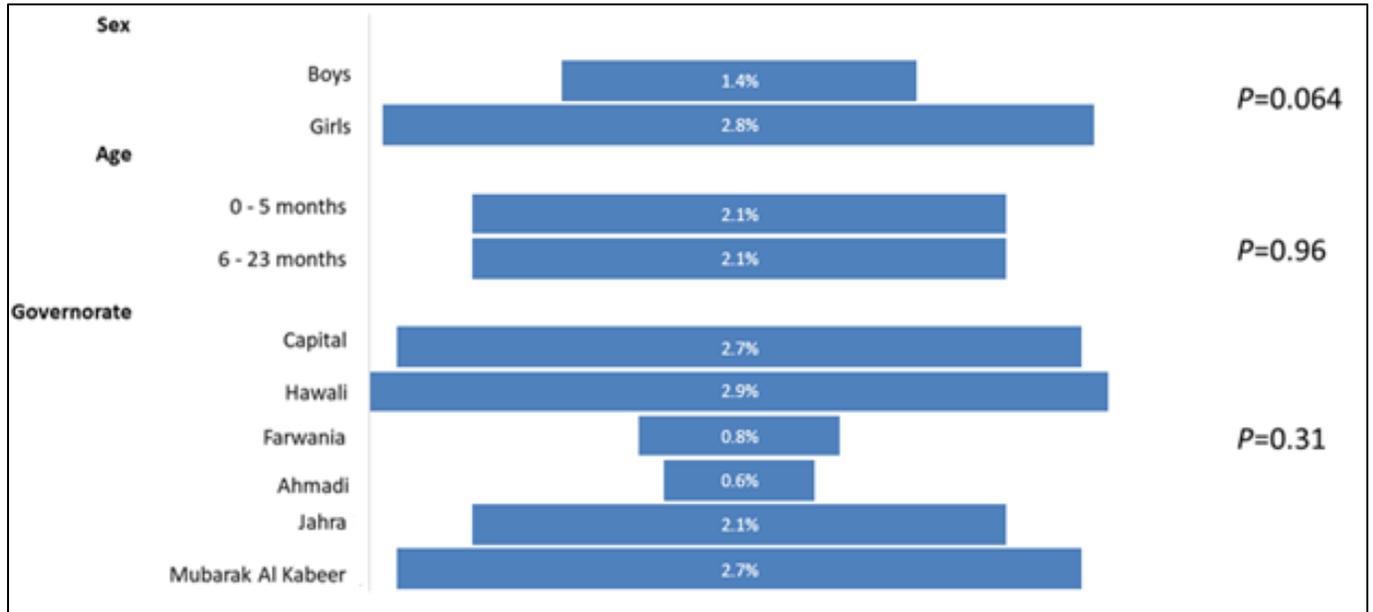
| <b>Characteristic</b>                 |                     | <b>Adjusted OR<sup>1</sup></b> | <b>95% CI<sup>2</sup></b> |
|---------------------------------------|---------------------|--------------------------------|---------------------------|
| <b>Sex</b>                            |                     |                                | $P^3=0.21$                |
|                                       | Boys                | 1                              |                           |
|                                       | Girls               | 0.8                            | 0.6 – 1.1                 |
| <b>Age</b>                            |                     |                                | $P^3<0.0001$              |
|                                       | 0 – 5 months        | 1                              |                           |
|                                       | 6 – 23 months       | 2.1                            | 1.4 – 2.9                 |
| <b>Governorate</b>                    |                     |                                | $P^3<0.0001$              |
|                                       | Capital             | 1                              |                           |
|                                       | Hawali              | 2.0                            | 0.9 – 4.1                 |
|                                       | Farwania            | 1.8                            | 0.8 – 3.9                 |
|                                       | Ahmadi              | 7.8                            | 3.5 – 17.6                |
|                                       | Jahra               | 2.5                            | 1.2 – 5.1                 |
|                                       | Mubarak Al Kabeer   | 3.5                            | 1.7 – 7.3                 |
| <b>Early breastfeeding initiation</b> |                     |                                | $P^3=0.23$                |
|                                       | Yes                 | 1                              |                           |
|                                       | No                  | 0.8                            | 0.5 – 1.2                 |
| <b>Birth weight</b>                   |                     |                                | $P^3=0.0044$              |
|                                       | <2500 g             | 0.5                            | 0.3 – 0.7                 |
|                                       | <2500 to <4000 g    | 1                              |                           |
|                                       | ≥4000 g             | 1.3                            | 0.6 – 2.6                 |
| <b>Place of birth</b>                 |                     |                                | $P^3=0.029$               |
|                                       | Private hospital    | 1                              |                           |
|                                       | Government hospital | 0.6                            | 0.4 – 1.1                 |
|                                       | Others              | 2.9                            | 0.9 – 8.8                 |

<sup>1</sup>- Odds ratio adjusted for sex, age, residential place, early breastfeeding initiation, birth weight, and place of birth. <sup>2</sup>- 95% confidence interval. <sup>3</sup>-  $P$ -value for overweight status association with cofactor by Wald test.

### 3.4.3. Prevalence of wasting and stunting

- *Wasting*

Overall, wasting prevalence (Figure 4) was 2.1 % [95 % CI: 1.4 – 3.0]. No significant association was found with sex, age and living area.

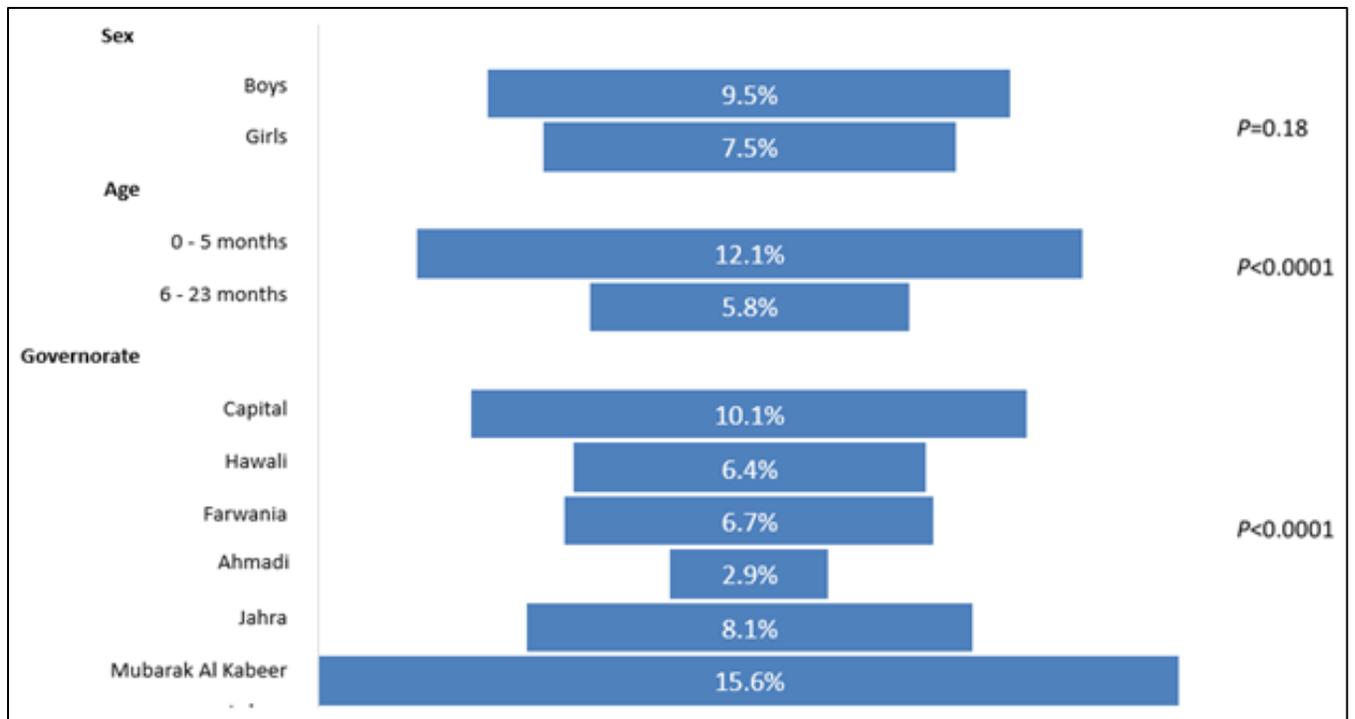


**Figure 4.** Prevalence of wasting by socio-demographic characteristics among children under 2 years.

*Figure caption:* P-value for wasting x cofactor issued by Chi-squared test.

- *Stunting*

Overall, stunting prevalence (Figure 5) was 8.4 % [95 % CI: 7.2 – 10.0]. Stunting was more prevalent among younger children (0-5 months). A higher prevalence was depicted in Mubarek Al Kabeer governorate (15.6 %) vs. 2.9% in Ahmadi governorate.



**Figure 5.** Prevalence of stunting by socio-demographic characteristics among children under 2 years.

*Figure caption:* P-value for stunting x cofactor issued by Chi-squared test.

## **Survey conducted among children under 5 years**

### *Results*

## 4. Results of the survey conducted among children under five years

### 4.1. Sample characteristics of children under five years

Table 10 describes the characteristics of children retained for the following study. The most important source of information was derived from mothers (77.4). Of them, 48.3% were girls and those aged between 4-5 years were the less representative. About 28% of the participants were recruited from the *Hawali* governorate and 11.8% from the *Farwania* governorate. Most children were breastfed, and only a fifth of them were sick in the past month.

**Table 10.** Characteristics of children (2–5 years, n=783) recruited in the Kuwait Nutritional Surveillance System in 2020

| <b>Characteristic</b>                    | <b>n</b>          | <b>% or mean</b> |
|--|-------------------|------------------|
| <b>Source of information</b>             |                   |                  |
|  | Mothers           | 77.4             |
|  | Fathers           | 20.4             |
|  | Others            | 2.2              |
| <b>Sex</b>                               |                   |                  |
|  | Female            | 51.7             |
|  | Male              | 48.3             |
| <b>Age</b>                               |                   |                  |
|  | 2 – 2.9 years     | 43.1             |
|  | 3 – 3.9 years     | 41.9             |
|  | 4 – 5 years       | 15.0             |
| <b>Governorate</b>                       |                   |                  |
|  | Capital           | 11.8             |
|  | Hawali            | 27.9             |
|  | Farwania          | 11.8             |
|  | Ahmadi            | 21.8             |
|  | Jahra             | 12.8             |
|  | Mubarak Al Kabeer | 13.9             |
| <b>Children ever breastfed</b>           |                   |                  |
|  | Yes               | 92.8             |
|  | No                | 7.2              |
| <b>Any illness during the last month</b> |                   |                  |
|  | Yes               | 28.4             |
|  | No                | 71.6             |

#### **4.2. Dietary consumption and eating behaviours among children under five years**

Overall, 23.2% [95% CI: 20.3 – 26.3] of children were identified as breakfast skippers. The prevalence of breakfast-skippers was found to be as high as 48.6% (Table 11) among children living in *Mubarak Al Kabeer* while only 1.7% were reported in *Ahmadi* governorate ( $P<0.0001$ ).

Most children consumed at least four food groups (Table 11). The lowest prevalence of compliers was found in *Hawali* governorate, while nearly all children living in the Capital were identified as compliers (98.9%).

The weekly frequency of carbonated drinks consumption (Table 11) was consumed one time per week on average. The frequency of consumption was found to increase by age ( $p=0.001$ ) and to vary significantly across governorates ( $p<0.0001$ ).

Finally, the non-fresh drinks were consumed four times per week on average. The consumption did not vary by sex and age (Table 11). The highest frequency was reported in the *Jahra* governorate (5.4 times per week) and the lowest in the Capital (3.3 times per week).

#### **4.3. Time of screen use**

Table 12 shows TV and computer use frequency on a typical weekday and during the weekend. Approximately a quarter of children tend to use the TV for 2 hours or more per day on average. Computer use was predominately used by children (vs. TV) as around 30% of children used it for two or more hours per day.

#### **4.4. Prevalence and risk factors of overweight and obesity**

Table 13 shows that older children were at a higher risk of being overweight. The overall prevalence was 11.3% [95 % CI: 9.3 – 13.8] (7.1 [95 % CI: 5.4 – 9.1] for overweight without obesity) None of the other assessed cofactors was found to be associated with overweight.

**Table 11.** Breakfast skipping, minimum dietary diversity, carbonated drinks, and non-fresh drinks consumption among children under 5 years by socio-demographic characteristics

| Characteristic     | Breakfast skipping |                     | Dietary diversity score (≥4 groups) |                     | Weekly frequency of carbonated drinks consumption (times per week) |                     | Weekly frequency of non-fresh drinks consumption (times per week) |                     |
|--------------------|--------------------|---------------------|-------------------------------------|---------------------|--|---------------------|---|---------------------|
|                    | %                  | 95% CI <sup>1</sup> | %                                   | 95% CI <sup>1</sup> | Mean   | 95% CI <sup>1</sup> | Mean  | 95% CI <sup>1</sup> |
| <b>Sex</b>         | $P^2=0.46$         |                     | $P^2=0.49$                          |                     | $P^3=0.16$   |                     | $P^3=0.81$  |                     |
| Boys               | 22.1               | 18.3 – 26.4         | 82.8                                | 78.8 – 86.2         | 1.0  | 0.8 – 1.1           | 4.1   | 3.9 – 4.3           |
| Girls              | 24.3               | 20.2 – 28.9         | 80.8                                | 76.4 – 84.5         | 0.8  | 0.7 – 1.0           | 4.1   | 3.9 – 4.3           |
| <b>Age</b>         | $P^2=0.059$        |                     | $P^2=0.31$                          |                     | $P^3=0.001$  |                     | $P^3=0.14$  |                     |
| 2 – 2.9 years      | 19.2               | 15.3 – 23.7         | 79.4                                | 74.7 – 83.4         | 0.7  | 0.5 – 0.8           | 3.9   | 3.7 – 4.2           |
| 3 – 3.9 years      | 26.9               | 22.3 – 32.0         | 83.8                                | 79.3 – 87.4         | 1.0  | 0.9 – 1.2           | 4.2   | 4.0 – 4.4           |
| 4 – 5.9 years      | 24.1               | 17.2 – 32.7         | 83.4                                | 75.5 – 89.2         | 1.2  | 0.9 – 1.5           | 4.3   | 3.9 – 4.7           |
| <b>Governorate</b> | $P^2<0.0001$       |                     | $P^2<0.0001$                        |                     | $P^3<0.0001$   |                     | $P^3<0.0001$  |                     |
| Capital            | 17.4               | 10.9 – 26.5         | 98.9                                | 92.5 – 99.8         | 0.8  | 0.5 – 1.0           | 3.3   | 2.7 – 3.8           |
| Hawali             | 25.7               | 20.2 – 31.9         | 48.3                                | 41.6 – 55.1         | 0.6  | 0.4 – 0.7           | 3.6   | 3.3 – 3.9           |
| Farwania           | 20.6               | 13.6 – 30.4         | 88.0                                | 79.6 – 93.2         | 0.7  | 0.4 – 0.9           | 3.6   | 3.3 – 4.0           |
| Ahmadi             | 1.7                | 0.1 – 5.3           | 96.4                                | 92.3 – 98.4         | 1.1  | 0.9 – 1.2           | 4.1   | 3.9 – 4.2           |
| Jahra              | 35.0               | 26.2 – 44.8         | 92.0                                | 84.7 – 95.9         | 1.6  | 1.2 – 1.9           | 5.4   | 5.1 – 5.6           |
| Mubarak Al Kabeer  | 48.6               | 39.1 – 58.0         | 94.3                                | 88.1 – 97.4         | 1.1  | 0.7 – 1.5           | 5.1   | 4.7 – 5.5           |

<sup>1</sup>- 95% confidence interval. <sup>2</sup>- P-value for the association eating behaviours (breakfast skipping and minimum dietary diversity) with cofactor issued by Chi-squared test. <sup>3</sup>- P-value for the association eating behaviours (Weekly frequency of carbonated drinks consumption and Weekly frequency of non-fresh drinks consumption) with cofactor issued by Wald test (post estimation following the linear regression).

**Table 12.** Time screen use among children under five years

|                                     | %    | 95% CI      |
|-------------------------------------|------|-------------|
| TV watching during the weekend      |      |             |
| <2 hours                            | 78.8 | 75.8 – 81.5 |
| 2 – 3 hours                         | 14.3 | 12.1 – 17.0 |
| >3 hours                            | 6.8  | 5.2 – 8.8   |
| TV watching during the week         |      |             |
| <2 hours                            | 78.5 | 75.5 – 81.3 |
| 2 – 3 hours                         | 14.8 | 12.4 – 17.4 |
| >3 hours                            | 6.6  | 5.1 – 8.6   |
| Computer playing during the weekend |      |             |
| <2 hours                            | 68.6 | 65.4 – 71.9 |
| 2 – 3 hours                         | 22.5 | 19.8 – 25.6 |
| >3 hours                            | 8.6  | 6.8 – 10.7  |
| Computer use during the week        |      |             |
| <2 hours                            | 70.4 | 67.1 – 73.5 |
| 2 – 3 hours                         | 20.9 | 18.2 – 23.9 |
| >3 hours                            | 8.6  | 6.8 – 10.7  |

**Table 13.** Logistic regression for the association of lifestyle factors, eating behaviours, and socio-demographic characteristics with overweight.

|   | n  | %    | Adjusted OR <sup>1</sup> | 95% CI <sup>2</sup> |
|---|----|------|--------------------------|---------------------|
| <b>Sex</b>  |    |      |                          |                     |
| Boys  | 42 | 10.4 | 1                        |                     |
| Girls   | 46 | 12.2 | 1.2                      | 0.8 – 1.9           |
| <b>Age</b>  |    |      |                          |                     |
| 2.0 – 2.9 years   | 48 | 14.3 | 1                        |                     |
| 3.0 – 3.9 years   | 29 | 8.9  | 0.6                      | 0.3 – 0.9           |
| 4.0 – 5.9 years   | 11 | 9.4  | 0.6                      | 0.3 – 1.3           |
| <b>Breakfast skipping</b>   |    |      |                          |                     |
| Yes   | 27 | 10.3 | 1.6                      | 0.9 – 2.7           |
| No  | 61 | 15.2 | 1                        |                     |
| <b>MDD score</b>  |    |      |                          |                     |
| ≥4  | 68 | 10.9 | 1                        |                     |
| <4  | 19 | 13.9 | 1.2                      | 0.7 – 2.2           |
| <b>Weekly frequency of carbonated drinks consumption (times per week)</b> | -  | -    | 1.0                      | 0.8 – 1.1           |
| <b>Weekly frequency of non-fresh drinks consumption (times per week)</b>  | -  | -    | 1.0                      | 0.9 – 1.2           |
| <b>TV watching during the week</b>  |    |      |                          |                     |
| <2 hours  | 70 | 11.5 | 1                        |                     |
| 2 – 3 hours   | 13 | 11.5 | 1.2                      | 0.5 – 2.8           |
| >3 hours  | 5  | 9.8  | 1.1                      | 0.3 – 3.9           |
| <b>Computer use during the week</b>                                       |    |      |                          |                     |
| <2 hours  | 67 | 12.2 | 1                        |                     |
| 2 – 3 hours   | 16 | 9.9  | 0.8                      | 0.4 – 1.8           |
| >3 hours  | 5  | 7.6  | 0.6                      | 0.2 – 2.1           |

<sup>1</sup>- Adjusted odds ratio for sex, age, breakfast skipping status, MDD score, Weekly frequency of carbonated drinks consumption (times per week), Weekly frequency of non-fresh drinks consumption (times per week), TV watching during a weekday, and Computer use during a weekday. <sup>2</sup>- 95% confidence interval

#### 4.5. Prevalence of wasting and stunting

Table 14 shows that the national prevalence of wasting and stunting is 2.7 [95 % CI: 1.7 – 4.1] and 2.3 [95 % CI: 1.5 – 3.6], respectively.

**Table 14.** Prevalence of wasting and stunting among children under five years by socio-demographic characteristics

|                    |                   | Wasting |                      |                     | Stunting |                       |                     |
|--------------------|-------------------|---------|----------------------|---------------------|----------|-----------------------|---------------------|
|                    |                   | n       | Prevalence           | 95% CI <sup>1</sup> | n        | Prevalence            | 95% CI <sup>1</sup> |
| <b>National</b>    |                   | 20      | 2.7                  | 1.7 – 4.1           | 18       | 2.3                   | 1.5 – 3.6           |
| <b>Sex</b>         |                   |         | P <sup>2</sup> =0.82 |                     |          | P <sup>2</sup> =0.74  |                     |
|                    | Boys              | 11      | 2.8                  | 1.5 – 4.9           | 10       | 2.5                   | 1.3 – 4.6           |
|                    | Girls             | 9       | 2.5                  | 1.3 – 4.7           | 8        | 2.1                   | 1.1 – 4.2           |
| <b>Age</b>         |                   |         | P <sup>2</sup> =0.21 |                     |          | P <sup>2</sup> =0.76  |                     |
|                    | 2.0 – 2.9 years   | 11      | 3.2                  | 1.8 – 5.8           | 7        | 2.1                   | 1.0 – 4.3           |
|                    | 3.0 – 3.9 years   | 9       | 2.8                  | 1.4 – 5.2           | 9        | 2.8                   | 1.4 – 5.2           |
|                    | 4.0 – 5.9 years   | 0       | 0.0                  |                     | 2        | 1.7                   | 0.4 – 6.6           |
| <b>Governorate</b> |                   |         | P <sup>2</sup> =0.32 |                     |          | P <sup>2</sup> =0.005 |                     |
|                    | Capital           | 3       | 3.3                  | 1.1 – 9.9           | 7        | 7.6                   | 3.6 – 15.1          |
|                    | Hawali            | 8       | 3.8                  | 1.9 – 7.4           | 5        | 2.3                   | 1.0 – 5.4           |
|                    | Farwania          | 1       | 1.1                  | 0.2 – 7.4           | 3        | 3.2                   | 1.1 – 9.7           |
|                    | Ahmadi            | 1       | 0.6                  | 0.1 – 4.1           | 0        | 0.0                   |                     |
|                    | Jahra             | 4       | 4.3                  | 1.6 – 11.1          | 1        | 1.0                   | 0.1 – 6.8           |
|                    | Mubarak Al Kabeer | 3       | 2.9                  | 0.1 – 8.7           | 2        | 1.9                   | 0.5 – 7.1           |

<sup>1</sup>- 95 % confidence interval. <sup>2</sup>-P-value for wasting (or stunting) x cofactor issued by Chi-squared test.

## **Survey conducted among adults**

### *Results*

## 5. Results of the survey conducted among adults

### 5.1. Sample characteristics

A total of 665 women and 461 men were surveyed, from which clinical, anthropometric, dietary, lifestyle and socio-demographic data were collected (Table 15). The mean age was 39.8 (0.4) years, the minimum was 18 years, and the maximum was 90 years in accordance with the inclusion criteria. Most adults had university schooling level, but 1 out of 3 had no professional occupation. Almost one out of five were found to be active smokers. Mean weight was 77.3 (0.5) kg, mean height 163.7 (0.3) cm, mean BMI was 28.8 kg/m<sup>2</sup>.

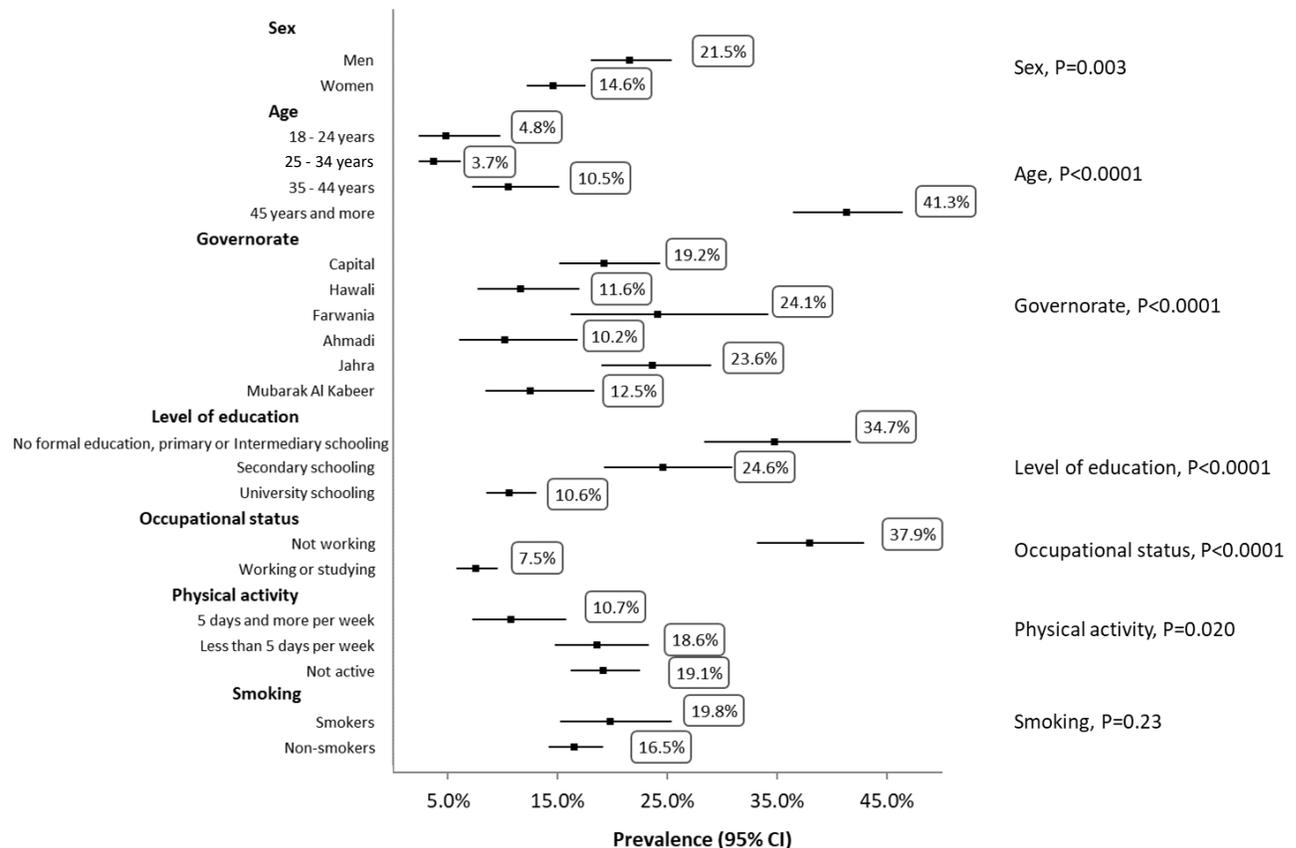
**Table 15.** Socio-demographic characteristics and place of residence of Kuwaiti adults in 2020 (n = 1156).

|  | n   | %    |
|--|-----|------|
| <b>Sex</b>                                   |     |      |
| Men  | 461 | 40.9 |
| Women  | 665 | 59.1 |
| <b>Age</b>                                   |     |      |
| 18 – 24 years                                | 137 | 12.2 |
| 25 – 34 years                                | 392 | 34.8 |
| 35 – 44 years                                | 230 | 20.4 |
| 45 years and more                            | 367 | 32.6 |
| <b>Region</b>                                |     |      |
| Capital                                      | 284 | 25.2 |
| Hawali                                       | 174 | 15.5 |
| Farwania                                     | 86  | 7.6  |
| Ahmadi                                       | 127 | 11.3 |
| Jahra  | 281 | 25.0 |
| Mubarak Al Kabeer                            | 174 | 15.5 |
| <b>Level of education</b>                    |     |      |
| No formal, primary or intermediary schooling | 188 | 16.8 |
| Secondary schooling                          | 209 | 18.7 |
| University schooling                         | 723 | 64.6 |
| <b>Occupational status</b>                   |     |      |
| Not working                                  | 369 | 32.8 |
| Working or studying                          | 755 | 67.2 |
| <b>Physical activity</b>                     |     |      |
| More than 5 days a week                      | 197 | 17.7 |
| Less than 5 days a week                      | 310 | 27.9 |
| Not active                                   | 604 | 54.4 |
| <b>Smoking</b>                               |     |      |
| Yes  | 238 | 20.8 |
| No   | 914 | 79.2 |

## 5.2. Self-reported diabetes

### 5.2.1. Prevalence and association with cofactors

The prevalence of diabetes (Figure 6) reached 17.3% with 95% CI [15.1 – 19.6] during the study year. A significant difference was depicted across socio-demographic characteristics variables ( $p$  values  $\leq 0.020$ ) except for smoking.



**Figure 6.** Self-reported diabetes prevalence among Kuwaiti adults (19 years and more).

*Figure caption:* P-values: Chi-squared test for having diabetes x factor variable.

### 5.2.2. Risk factors of diabetes among adults

The logistic regression analysis (Table 16) showed that the increase of the age by one year is associated with an increased odds of self-reported diabetes by 8%. In general, subjects living in the different regions showed a similar risk of being diabetics except for the *Ahmadi* governorate, where the risk was 60% lower than the Capital. Having a secondary

schooling level (adjusted OR=1.8, 95% CI [1.1 – 2.8]; vs. University schooling) or obese (adjusted OR=2.5, 95% CI [1.4 – 4.6]; vs. normal or thin) was associated with a significantly increased risk of diabetes.

**Table 16.** Association between self-reported diabetes with the place of residence, socio-demographic factors, anthropometry, and lifestyle factors

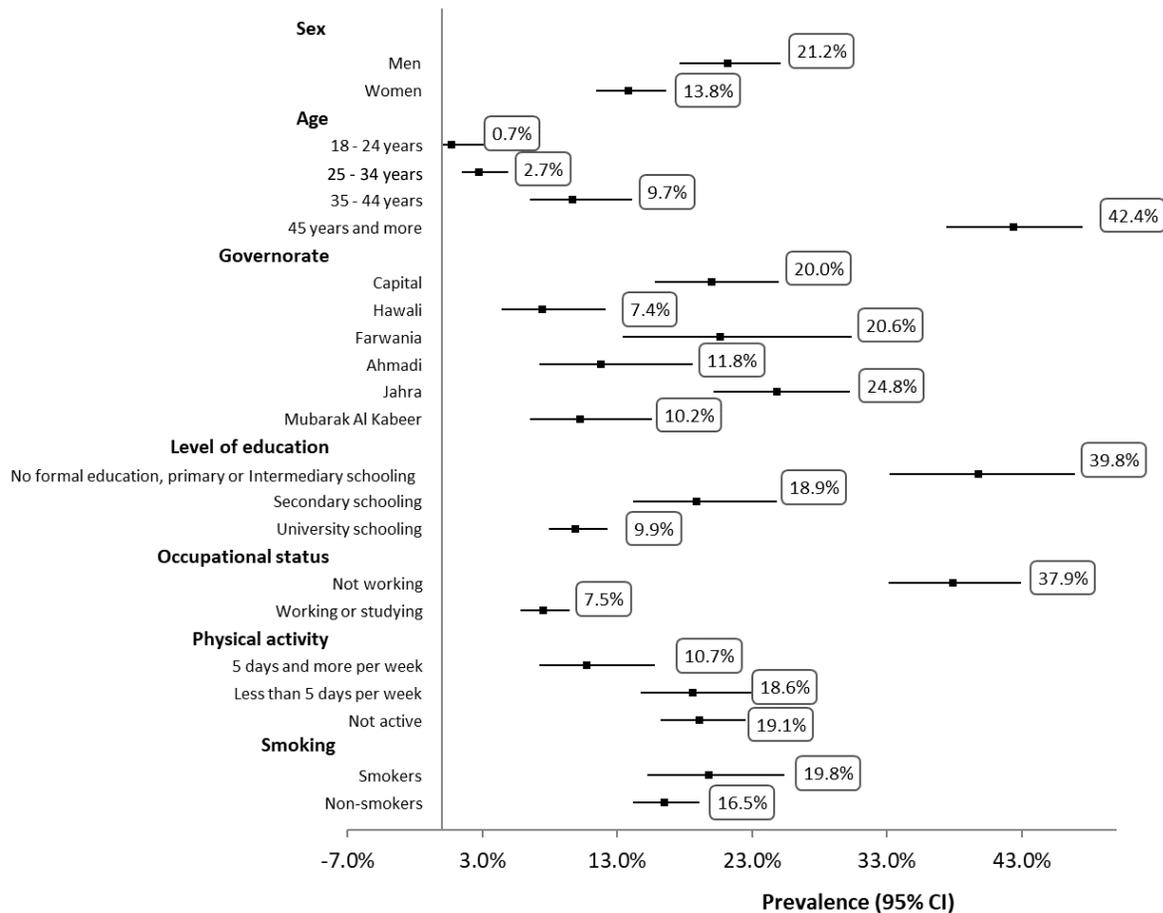
|  | Logistic regression           |                     |                             |                     |
|--|-------------------------------|---------------------|-----------------------------|---------------------|
|  | Crude                         |                     | Adjusted                    |                     |
|  | OR <sup>1</sup>               | 95% CI <sup>2</sup> | OR <sup>1</sup>             | 95% CI <sup>2</sup> |
| Total  | –                             |                     | –                           |                     |
| <b>Sex</b>   | <i>P</i> <sup>3</sup> =0.0013 |                     | <i>P</i> <sup>3</sup> =0.75 |                     |
| Men  | 1                             |                     | 1                           |                     |
| Women  | 0.6                           | 0.4 – 0.8           | 1.1                         | 0.7 – 1.7           |
|  | <i>P</i> <0.0001              |                     | <i>P</i> <0.0001            |                     |
| <b>Age</b>   | 1.1                           | 1.08 – 1.11         | 1.08                        | 1.05 – 1.1          |
| <b>Governorate</b>   | <i>P</i> =0.0002              |                     | <i>P</i> =0.053             |                     |
| Capital  | 1                             |                     | 1                           |                     |
| Hawali   | 0.5                           | 0.3 – 0.8           | 0.6                         | 0.3 – 1.2           |
| Farwania   | 1.4                           | 0.8 – 2.4           | 1.2                         | 0.5 – 2.5           |
| Ahmadi   | 0.5                           | 0.3 – 0.9           | 0.4                         | 0.2 – 0.8           |
| Jahra  | 1.3                           | 0.9 – 2.0           | 0.7                         | 0.4 – 1.2           |
| Mubarak Al Kabeer  | 0.6                           | 0.4 – 1.1           | 0.7                         | 0.4 – 1.4           |
| <b>Level of education</b>  | <i>P</i> <0.0001              |                     | <i>P</i> =0.034             |                     |
| No formal, primary or intermediate schooling                             | 4.9                           | 3.4 – 7.3           | 1.1                         | 0.6 – 1.9           |
| Secondary schooling  | 2.9                           | 1.9 – 4.4           | 1.8                         | 1.1 – 2.8           |
| University schooling   | 1                             |                     | 1                           |                     |
| <b>Occupational status</b>   | <i>P</i> <0.0001              |                     | <i>P</i> =0.081             |                     |
| Not working/ not studying  | 8.0                           | 5.7 – 11.4          | 1.6                         | 0.9 – 2.7           |
| Working or studying  | 1                             |                     | 1                           |                     |
| <b>Physical activity</b>   | <i>P</i> =0.016               |                     | <i>P</i> =0.21              |                     |
| More than 5 days a week  | 1                             |                     | 1                           |                     |
| Less than 5 days a week  | 1.8                           | 1.1 – 3.2           | 1.6                         | 0.8 – 3.2           |
| Not active   | 2.1                           | 1.3 – 3.5           | 1.7                         | 0.9 – 3.1           |
| <b>Smoking</b>   | <i>P</i> =0.15                |                     | <i>P</i> =0.12              |                     |
| No   | 1                             |                     | 1                           |                     |
| Yes  | 1.3                           | 0.9 – 1.9           | 1.5                         | 0.9 – 2.7           |
| <b>Corpulence</b>  | <i>P</i> <0.0001              |                     | <i>P</i> =0.0029            |                     |
| Thinness and normal (<25 kg/m <sup>2</sup> or <-2 z score)               | 1                             |                     | 1                           |                     |
| Overweight (≥25kg/m <sup>2</sup> to <30 kg/m <sup>2</sup> or >1 z score) | 3.1                           | 1.8 – 5.3           | 1.5                         | 0.8 – 2.8           |
| Obesity (≥30kg/m <sup>2</sup> or >2 z score)                             | 5.5                           | 3.2 – 9.5           | 2.5                         | 1.4 – 4.7           |

<sup>1</sup>- Odds ratio. <sup>2</sup>- 95% confidence interval. <sup>3</sup>- Crude or adjusted P-value for association of having diabetes with co-factor

### 5.3. Self-reported hypertension

#### 5.3.1. Prevalence of Self-reported hypertension and association with cofactors

The analysis showed that 16.9% with 95% CI (14.8 – 19.2) of adults were affected by hypertension. The prevalence was unevenly distributed across categories of cofactors (figure 7) except for smoking ( $P=0.81$ ). Self-reported hypertension appeared to be more prevalent among women and increased by age. However, the prevalence was higher among those with low education level, not working, having physical activity for less than five days per week or being not active ( $P$  values from 0.021 to  $<0.0001$ ).



**Figure 7.** Self-reported hypertension prevalence among Kuwaiti adults (19 years and more).  
*Figure caption:* P-values: Chi-squared test for being hypertensive x factor variable.

### 5.3.2. Risk factors of self-reported hypertension among adults

The regression analysis (Table 17) revealed that the age increase by one year was associated with an increased odds of self-reported hypertension by 9%. A similar risk level of hypertension was found across governorates. Being overweight (adjusted OR=2.0, 95% CI [1.01 – 4.1]; vs. thin or normal) or obese (adjusted OR=3.4, 95% CI [1.7 – 6.7] was associated with the risk of being hypertensive).

**Table 17.** Association between self-reported hypertension with the place of residence, socio-demographic factors, anthropometry, and lifestyle factors

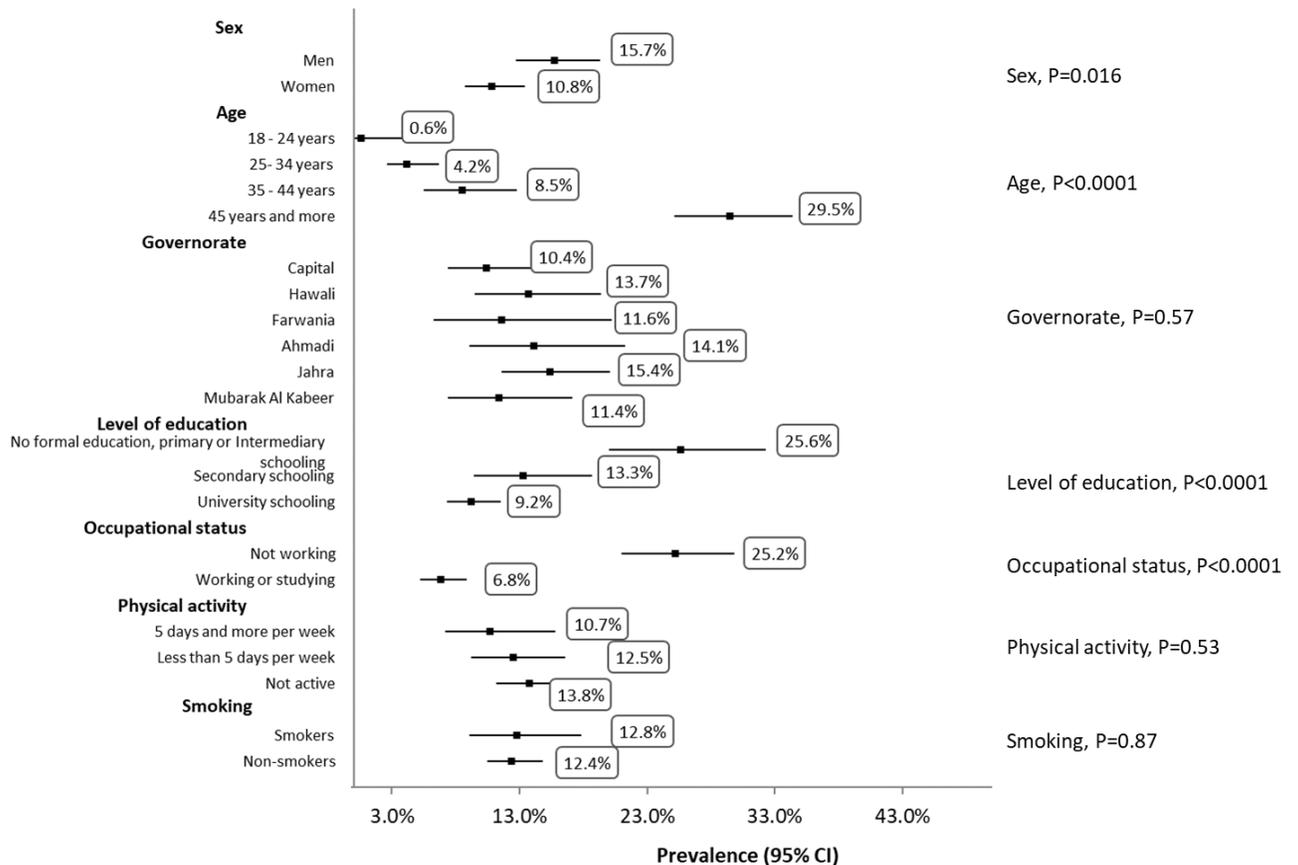
|  | Logistic regression   |                     |                          |                     |
|--|-----------------------|---------------------|--------------------------|---------------------|
|  | Crude OR <sup>1</sup> | 95% CI <sup>2</sup> | Adjusted OR <sup>1</sup> | 95% CI <sup>2</sup> |
| <b>Sex</b>   | $P^3=0.0013$          |                     | $P^3=0.61$               |                     |
| Men  | 1                     |                     | 1                        |                     |
| Women  | 0.6                   | 0.4 – 0.8           | 1.1                      | 0.7 – 1.8           |
|  | $P<0.0001$            |                     | $P<0.0001$               |                     |
| <b>Age (years)</b>   | 1.1                   | 1.09 – 1.13         | 1.09                     | 1.07 – 1.11         |
| <b>Governorate</b>   | $P<0.0001$            |                     | $P=0.016$                |                     |
| Capital  | 1                     |                     | 1                        |                     |
| Hawali   | 0.3                   | 0.2 – 0.6           | 0.4                      | 0.2 – 0.8           |
| Farwania   | 1.0                   | 0.6 – 1.9           | 0.9                      | 0.4 – 2.1           |
| Ahmadi   | 0.5                   | 0.3 – 0.9           | 0.4                      | 0.2 – 0.8           |
| Jahra  | 1.3                   | 0.8 – 1.9           | 0.5                      | 0.3 – 0.9           |
| Mubarak Al Kabeer  | 0.5                   | 0.3 – 0.8           | 0.5                      | 0.2 – 0.9           |
| <b>Level of education</b>  | $P<0.0001$            |                     | $P=0.44$                 |                     |
| No formal, primary, or intermediate schooling                            | 5.8                   | 4.0 – 8.5           | 1.7                      | 0.8 – 2.4           |
| Secondary schooling  | 2.1                   | 1.3 – 3.1           | 1.1                      | 0.6 – 1.8           |
| University   | 1                     |                     | 1                        |                     |
| <b>Occupational status</b>   | $P<0.0001$            |                     | $P=0.20$                 |                     |
| Not working/ not studying  | 9.1                   | 6.4 – 13.1          | 1.4                      | 0.8 – 2.5           |
| Working or studying  | 1                     |                     | 1                        |                     |
| <b>Physical activity</b>   | $P=0.047$             |                     | $P=0.24$                 |                     |
| More than 5 days a week  | 1                     |                     | 1                        |                     |
| Less than 5 days a week  | 1.9                   | 1.1 – 3.2           | 1.7                      | 0.9 – 3.4           |
| Not active   | 1.8                   | 1.1 – 3.0           | 1.3                      | 0.7 – 2.4           |
| <b>Smoking</b>   | $P=0.89$              |                     | $P=0.45$                 |                     |
| No   | 1                     |                     | 1                        |                     |
| Yes  | 1.0                   | 0.7 – 1.5           | 1.3                      | 0.7 – 2.3           |
| <b>Corpulence</b>  | $P<0.0001$            |                     | $P=0.0009$               |                     |
| Thinness and normal (<25 kg/m <sup>2</sup> or <-2 z score)               | 1                     |                     | 1                        |                     |
| Overweight (≥25kg/m <sup>2</sup> to <30 kg/m <sup>2</sup> or >1 z score) | 3.7                   | 2.1 – 6.8           | 2.0                      | 1.01 – 4.1          |
| Obesity (≥30kg/m <sup>2</sup> or >2 z score)                             | 6.8                   | 3.8 – 12.2          | 3.4                      | 1.7 – 6.7           |

<sup>1</sup>Odds ratio. <sup>2</sup> 95% confidence interval. <sup>3</sup> Crude or adjusted P-value for association of being hypertensive with co-factor

## 5.4. Self-reported hypercholesterolemia

### 5.4.1. Prevalence and association with cofactors

The study showed that 12.5% with 95% CI [10.6 – 14.5] of adults self-reported hypercholesterolemia. The self-reported hypercholesterolemia prevailed more among women and increased with age (Figure 8). However, the prevalence was found to be higher among those having low education levels ( $P < 0.0001$ ) and not working ( $P < 0.0001$ ).



**Figure 8.** Self-reported hypercholesterolemia prevalence among Kuwaiti adults (19 years and more).

P-values: Chi-squared test for having hypercholesterolemia x factor variable.

### 5.4.2. Risk factors of hypercholesterolemia among adults

The adjusted association between self-reported hypercholesterolemia estimated using logistic regression (Table 18) showed that no sex difference exists, and age increase appeared to be a significant risk factor (OR= 1.08, 95% CI [1.06 – 1.11]). Being obese was

positively associated with hypertensive status (OR= 2.1, 95% CI [1.1 – 4.2]). The marked unadjusted differences between sex and according to the level of education as well as occupational status did not stand after adjustment.

**Table 18.** Association between self-reported hypercholesterolemia and place of residence, socio-demographic factors, anthropometry, and lifestyle factors

|  | Logistic regression          |                     |                             |                     |
|--|------------------------------|---------------------|-----------------------------|---------------------|
|  | Crude                        |                     | Adjusted                    |                     |
|  | OR <sup>1</sup>              | 95% CI <sup>2</sup> | OR <sup>1</sup>             | 95% CI <sup>2</sup> |
| <b>Sex</b>   | <i>P</i> <sup>3</sup> =0.009 |                     | <i>P</i> <sup>3</sup> =0.94 |                     |
| Men  | 1                            |                     | 1                           |                     |
| Women  | 0.6                          | 0.4 – 0.9           | 1.0                         | 0.6 – 1.6           |
|  | <i>P</i> <0.0001             |                     | <i>P</i> <0.0001            |                     |
| <b>Age (year)</b>  | 1.08                         | 1.07 – 1.10         | 1.08                        | 1.06 – 1.11         |
| <b>Governorate</b>   | <i>P</i> =0.44               |                     | <i>P</i> =0.026             |                     |
| Capital  | 1                            |                     | 1                           |                     |
| Hawali   | 1.3                          | 0.7 – 2.3           | 1.9                         | 0.9 – 3.8           |
| Farwania   | 1.2                          | 0.6 – 2.7           | 1.3                         | 0.5 – 3.1           |
| Ahmadi   | 1.5                          | 0.8 – 2.9           | 1.6                         | 0.8 – 3.3           |
| Jahra  | 1.7                          | 1.02 – 2.9          | 1.0                         | 0.5 – 1.9           |
| Mubarak Al Kabeer  | 1.2                          | 0.7 – 2.3           | 1.7                         | 0.8 – 3.6           |
| <b>Level of education</b>  | <i>P</i> <0.0001             |                     | <i>P</i> =0.089             |                     |
| No formal, primary or intermediate schooling                             | 3.9                          | 2.6 – 5.9           | 1.0                         | 0.6 – 1.8           |
| Secondary schooling  | 1.7                          | 1.1 – 2.8           | 1.1                         | 0.7 – 1.9           |
| University   | 1                            |                     | 1                           |                     |
| <b>Occupational status</b>   | <i>P</i> <0.0001             |                     | <i>P</i> =0.93              |                     |
| Not working/ not studying  | 5.0                          | 3.4 – 7.3           | 1.0                         | 0.6 – 1.7           |
| Working or studying  | 1                            |                     | 1                           |                     |
| <b>Physical activity</b>   | <i>P</i> =0.29               |                     | <i>P</i> =0.90              |                     |
| More than 5 days a week  | 1                            |                     | 1                           |                     |
| Less than 5 days a week  | 1.2                          | 0.7 – 2.2           | 1.1                         | 0.5 – 2.1           |
| Not active   | 1.5                          | 0.9 – 2.5           | 1.1                         | 0.6 – 2.1           |
| <b>Smoking</b>   | <i>P</i> =0.78               |                     | <i>P</i> =0.49              |                     |
| No   | 1                            |                     | 1                           |                     |
| Yes  | 1.1                          | 0.7 – 1.7           | 1.2                         | 0.7 – 2.2           |
| <b>Corpulence</b>  | <i>P</i> <0.0001             |                     | <i>P</i> =0.097             |                     |
| Thinness and normal (<25 kg/m <sup>2</sup> or <-2 z score)               | 1                            |                     | 1                           |                     |
| Overweight (≥25kg/m <sup>2</sup> to <30 kg/m <sup>2</sup> or >1 z score) | 4.0                          | 2.0 – 7.7           | 2.0                         | 0.9 – 4.1           |
| Obesity (≥30kg/m <sup>2</sup> or >2 z score)                             | 5.1                          | 2.6 – 9.8           | 2.1                         | 1.1 – 4.2           |

<sup>1</sup>- Odds ratio. <sup>2</sup>- 95% confidence interval. <sup>3</sup>- Crude or adjusted P-value for association of hypercholesterolemia with co-factor

## 5.5. Lifestyle factors

### 5.5.1. Dietary intake

The average daily intake of fruits and vegetables was found to be equivalent to  $2.58 \pm 0.08$  serving. Only 8.4% [95% CI: 6.9 – 10.3] and 6.2% [95% CI: 4.9 – 7.8] of adults reported adequate fruit and vegetable consumption levels, respectively. Fruit and vegetable consumption was positively associated with age (coef.=0.03 serving/d,  $p=0.001$ ). The adjusted linear regression analysis showed that in all governorates, except in the *Farwania* governorate (coef.=-0.6 serving/d,  $p=0.071$ ), fruit and vegetable consumption was higher in comparison to the Capital (coef.  $\geq 0.9$  serving/d,  $p$  values from 0.046 to  $<0.0001$ ). Being physically inactive was associated with a lower consumption (coef.=-0.8 serving/d,  $p<0.0001$ ) in comparison to active adults (for five days per week or more).

### 5.5.2. Physical activity

Overall, 45.6% [95% CI: 42.7 – 48.5] of the participants reported having moderate (less than five days in a week) to high (5 days or more in a week) levels of physical activity. Of them, 17.7% [95% CI: 15.5 – 20.1] practised physical activity for five days and more in a week. In adjusted logistic regression, women were more likely to be physically inactive (OR=2.5 [95% CI: 1.8 – 3.4]). Adults living in *Farwania* (OR=1.9 [95% CI: 1.1 – 3.3]), *Ahmadi* (OR=2.6 [95% CI: 1.6 – 4.2]), and *Mubarak Al Kabeer* (OR=2.0 [95% CI: 1.3 – 3.0]) governorates were more likely to be physically inactive. Unemployed adults had a 65% more risk of being physically inactive. Finally, obesity status was significantly identified as a predictor of physical inactivity at alpha risk equal 10%.

### 5.5.3. Smoking

The analysis showed that 20.8% [95% CI: 18.4 – 23.2] of participants were considered regular smokers. Most of them were men (46% [95% CI: 41.9 – 51.1] vs. 3.0% [95% CI: 1.9 – 4.6] for women). The adjusted logistic regression analysis found that females were less likely to be smokers (OR=0.03 [95% CI: 0.02 – 0.05]). Those who are living in *Farwania*

(OR=4.2 [95% CI: 1.9 – 9.5] vs. The Capital), *Ahmadi* (OR=2.1 [95% CI: 1.1 – 4.1]) and *Mubarak Al Kabeer* (OR=2.3 [95% CI: 1.03 – 4.9]) governorates were more likely of being smokers. Finally, having a secondary level of education (OR=1.8 [95% CI: 1.1 – 2.8] vs. University schooling) was a risk factor for smoking.

## **5.6. Anthropometric status**

### **5.6.1. Overweight and obesity prevalence**

Overall, 74.6% [95% CI: 71.9 – 77.1] were found to be overweight (38 % [95 % CI: 35.5 – 41.2] of overweight without obesity)). The overweight prevalence varied significantly across governorates ( $p<0.0001$ ): the highest prevalence (Table 19) was found in *Farwania* (73.7% [95% CI:]) while the lowest one was reported in the Capital (61.6% [95% CI:]). The overweight prevalence was inversely associated with the education level (88.3% vs. 70.5%,  $p<0.0001$ ). Overweight was less frequently reported among those having employment ( $p<0.0001$ ) or practising physical activity (66% for those practising physical activity vs. 77.2% for those not active,  $p=0.007$ ).

### **5.6.2. Relationship between subject-level overweight and obesity status and living environment, socio-demographic factors, and lifestyle factors**

Table 19 shows that, in comparison to subjects living in the Capital, those who were living in other governorates were at risk of overweight and obesity (OR=from 2.0 to 3.3,  $p$  values $<0.0001$ ). The age increase by one year was associated with an increased risk of overweight and obesity by 5%. In unadjusted analysis, subjects having low education level (OR=3.2 [95% CI: 2.0 – 5.1]), unemployed (OR=3.0 [95% CI:2.1 – 5.0]) and not practising a physical activity (OR=1.7 [95% CI: 1.2 – 2.5]) were at risk of overweight.

**Table 19.** Logistic regression for the association of overweight and obesity with socio-demographic and anthropometric characteristics

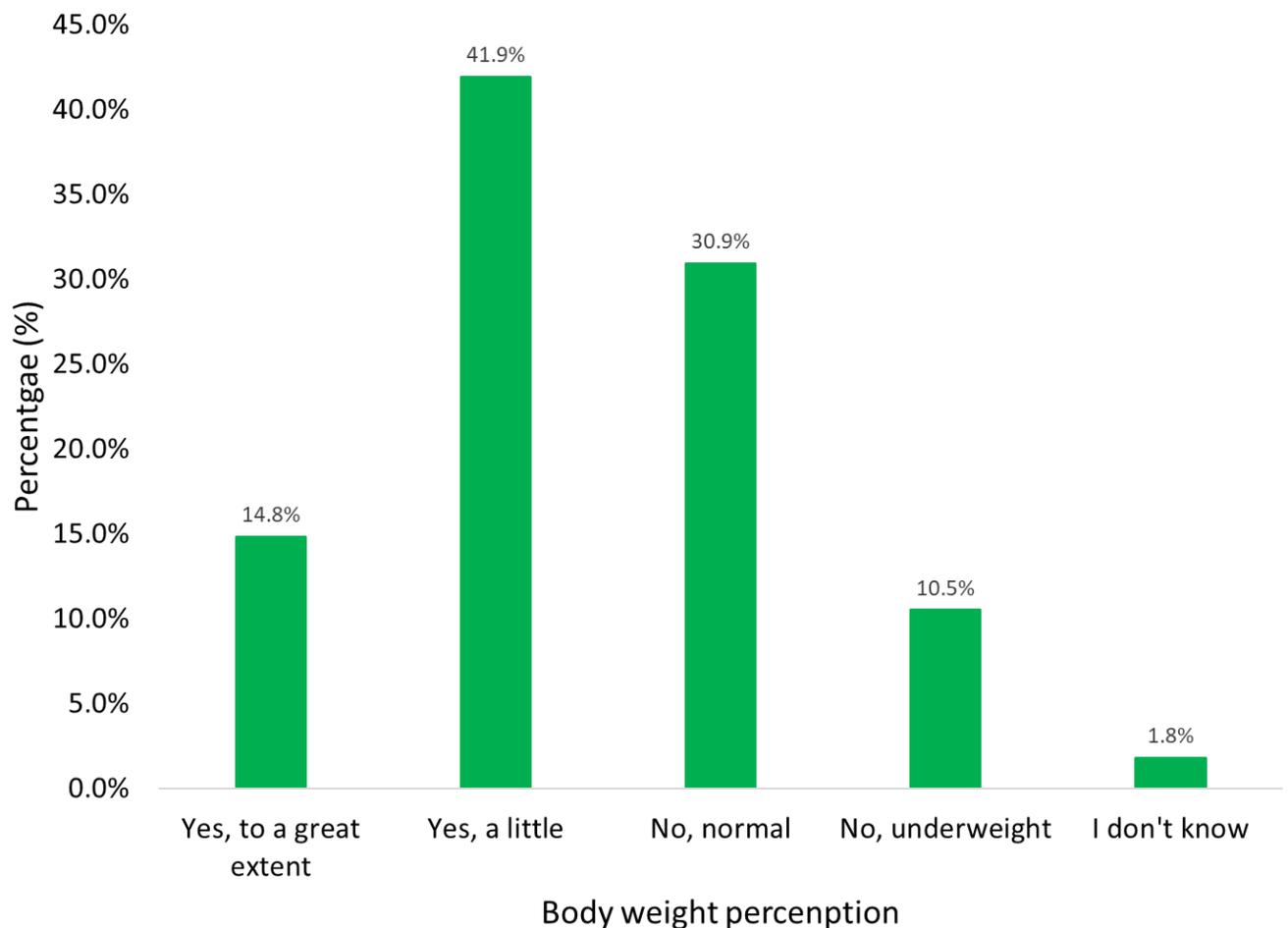
|  | n   | %    | Unadjusted analysis |                     | Adjusted analysis |                     |
|--|-----|------|---------------------|---------------------|-------------------|---------------------|
|  |     |      | OR <sup>1</sup>     | 95% CI <sup>2</sup> | OR <sup>1</sup>   | 95% CI <sup>2</sup> |
| <b>Sex</b>                                   |     |      | $P^3=0.069$         |                     | $P^3=0.21$        |                     |
| Men  | 357 | 77.4 | 1                   |                     | 1                 |                     |
| Women  | 483 | 72.6 | 0.8                 | 0.6 – 1.02          | 0.8               | 0.5 – 1.1           |
| <b>Age (year)</b>                            | -   | -    | $P^3<0.001$         |                     | $P^3<0.0001$      |                     |
|  |     |      | 1.06                | 1.04 – 1.08         | 1.05              | 1.03 – 1.07         |
| <b>Governorate</b>                           |     |      | $P^3<0.0001$        |                     | $P^3<0.0001$      |                     |
| Capital                                      | 175 | 61.6 | 1                   |                     | 1                 |                     |
| Hawali                                       | 127 | 73.0 | 1.7                 | 1.1 – 2.5           | 2.0               | 1.3 – 3.1           |
| Farwania                                     | 72  | 83.7 | 3.2                 | 1.7 – 5.9           | 3.3               | 1.7 – 6.3           |
| Ahmadi                                       | 107 | 84.2 | 3.3                 | 1.9 – 5.7           | 3.3               | 1.9 – 5.6           |
| Jahra  | 225 | 80.1 | 2.5                 | 1.7 – 3.7           | 2.1               | 1.4 – 3.1           |
| Mubarak Al Kabeer                            | 134 | 77.0 | 2.1                 | 1.4 – 3.2           | 2.7               | 1.6 – 4.3           |
| <b>Level of education</b>                    |     |      | $P^3<0.0001$        |                     | $P^3=0.46$        |                     |
| No formal, primary or intermediate schooling | 166 | 88.3 | 3.2                 | 2.0 – 5.1           | 1.2               | 0.7 – 2.0           |
| Secondary schooling                          | 159 | 76.1 | 1.3                 | 0.9 – 1.9           | 1.3               | 0.9 – 1.9           |
| University                                   | 510 | 70.5 | 1                   |                     | 1                 |                     |
| <b>Occupational status</b>                   |     |      | $P^3<0.0001$        |                     | $P^3=0.41$        |                     |
| Not working/ not studying                    | 320 | 86.7 | 3.0                 | 2.1 – 4.2           | 1.2               | 0.8 – 1.9           |
| Working or studying                          | 518 | 68.6 | 1                   |                     | 1                 |                     |
| <b>Physical activity</b>                     |     |      | $P^3=0.0075$        |                     | $P^3=0.18$        |                     |
| More than 5 days per a week                  | 130 | 66.0 | 1                   |                     | 1                 |                     |
| Less than 5 days per a week                  | 234 | 75.5 | 1.6                 | 1.1 – 2.3           | 1.4               | 0.9 – 2.2           |
| Not active                                   | 466 | 77.2 | 1.7                 | 1.2 – 2.5           | 1.4               | 0.9 – 2.0           |
| <b>Smoking</b>                               |     |      | $P^3=0.94$          |                     | $P^3=0.26$        |                     |
| No   | 174 | 74.7 | 1                   |                     | 1                 |                     |
| Yes  | 662 | 74.5 | 1.0                 | 0.7 – 1.4           | 0.8               | 0.5 – 1.2           |

<sup>1</sup>- Odds ratio. <sup>2</sup>- 95% confidence interval. <sup>3</sup>- Crude or adjusted P-value for association of overweight with co-factor issued by Wald test.

## 5.7. Bodyweight perception and management

### 5.7.1. Bodyweight perception

A total of 1124 responded to the question related to bodyweight perception (Figure 9). Most of them (41.9% [95% CI: 39.0 – 44.8]) reported perceiving their weight as 'a little' above average, while 30.9% [95% CI: 28.3 – 33.7] reported having an average body weight.



**Figure 9.** Weight perception of Kuwaiti Adults

### 5.7.2. Bodyweight perception by gender, education level, occupational status, and anthropometric status

Table 20 shows the association of body weight perception with socioeconomic and anthropometric cofactors.

**Table 20.** Association of bodyweight perception with socioeconomic and anthropometric factors

|                            |  | Percentage [95% CI] <sup>1</sup> |                      |                    |                        |
|----------------------------|--|----------------------------------|----------------------|--------------------|------------------------|
|                            |  | <i>Yes, to a great extent</i>    | <i>Yes, a little</i> | <i>No, normal</i>  | <i>No, underweight</i> |
| <b>Sex</b>                 |  | <i>P</i> <sup>2</sup> =0.010     |                      |                    |                        |
|                            | Men  | 12.8 [10.1 – 16.2]               | 40.3 [35.9 – 44.8]   | 36.6 [32.3 – 41.1] | 8.9 [6.6 – 11.9]       |
|                            | Women  | 16.2 [13.6 – 19.2]               | 43.0 [39.2 – 46.8]   | 27.1 [23.8 – 30.5] | 11.6 [9.3 – 14.2]      |
| <b>Level of education</b>  |  | <i>P</i> <sup>2</sup> =0.0010    |                      |                    |                        |
|                            | No formal, primary or intermediate schooling                             | 14.4 [10.1 – 20.2]               | 53.4 [46.3 – 60.5]   | 25.7 [19.9 – 32.4] | 4.2 [2.1 – 8.3]        |
|                            | Secondary schooling  | 17.7 [13.1 – 23.4]               | 39.7 [33.2 – 46.5]   | 34.4 [28.3 – 41.2] | 7.1 [4.3 – 11.2]       |
|                            | University schooling   | 14.2 [11.9 – 17.1]               | 39.4 [35.9 – 43.0]   | 31.4 [28.2 – 34.9] | 13.0 [28.2 – 34.9]     |
| <b>Occupational status</b> |  | <i>P</i> <sup>2</sup> =0.049     |                      |                    |                        |
|                            | Not working/ not studying  | 15.2 [11.9 – 19.3]               | 45.5 [40.4 – 50.6]   | 25.6 [21.4 – 30.3] | 10.9 [8.1 – 14.5]      |
|                            | Working or studying  | 14.7 [12.3 – 17.4]               | 40.1 [36.7 – 43.6]   | 33.5 [30.2 – 36.9] | 10.3 [8.3 – 12.7]      |
| <b>Physical activity</b>   |  | <i>P</i> <sup>2</sup> <0.0001    |                      |                    |                        |
|                            | More than 5 days a week  | 13.9 [9.1 – 18.6]                | 31.4 [25.3 – 38.3]   | 41.1 [34.3 – 48.1] | 12.1 [8.2 – 17.5]      |
|                            | Less than 5 days a week  | 10.3 [7.4 – 14.2]                | 46.2 [40.7 – 51.9]   | 32.0 [27.1 – 37.4] | 11.3 [8.2 – 15.3]      |
|                            | Not active   | 17.5 [14.7 – 20.8]               | 43.4 [39.5 – 47.4]   | 26.8 [23.5 – 30.6] | 9.6 [7.5 – 12.2]       |
| <b>Corpulence</b>          |  | <i>P</i> <sup>2</sup> <0.0001    |                      |                    |                        |
|                            | Thinness (<18.5kg/m <sup>2</sup> or <-2 z score)                         | 0.0                              | 15.3 [3.8 – 45.1]    | 46.1 [22.3 – 71.8] | 30.7 [12.0 – 59.1]     |
|                            | Normal (18.5 to <25 kg/m <sup>2</sup> or <1 z score)                     | 1.1 [0.4 – 3.3]                  | 23.4 [18.7 – 28.8]   | 57.9 [51.9 – 63.6] | 16.8 [12.9 – 21.7]     |
|                            | Overweight (≥25kg/m <sup>2</sup> to <30 kg/m <sup>2</sup> or >1 z score) | 9.5 [7.0 – 12.6]                 | 47.3 [42.6 – 52.0]   | 31.1 [26.9 – 35.6] | 10.4 [7.8 – 13.7]      |
|                            | Obesity (≥30kg/m <sup>2</sup> or >2 z score)                             | 30.2 [25.9 – 34.8]               | 49.3 [44.5 – 54.2]   | 12.2 [9.4 – 15.8]  | 5.6 [3.7 – 8.3]        |

<sup>1</sup>- 95% confidence interval. <sup>2</sup>- P value from Chi-squared test of body weight perception x cofactor. Participants that reported 'not know' were not displayed.

In crude analysis, body weight perception was different across all cofactor categories. Women tend to perceive more excess body weight than men. Subjects with low educational levels tend to report more being above normal weight '*to a great extent*' or '*a little*' compared to those who have achieved secondary or university level. High practise of physical activity (5 days per week) was associated with a higher report of '*normal*' body weight (41.1%) in comparison to those not practising any physical activity (26.8%,  $p<0.0001$ ). Also, the results showed that the proportion of overweight respondents who misperceived themselves as normal was equal to 31.1%. Moreover, 12.2% of obese respondents misperceived themselves as normal.

### 5.7.3. Relationship between subject-level misperception of body weight and sex

Table 21 shows that women are at risk of misunderstanding their body weight when they have normal body mass index. A similar tendency was observed for overweight but at an alpha risk of 7%.

**Table 21.** Logistic regression for the association of body weight misperception with sex

|                                | OR <sup>1</sup> | 95% CI <sup>2</sup> |
|--------------------------------|-----------------|---------------------|
| Misperception of normal weight | 2.2             | 1.2 – 3.9           |
| Misperception of overweight    | 0.7             | 0.5 – 1.04          |
| Misperception of obesity       | 1.4             | 0.9 – 2.0           |

### 5.7.4. Strategies for bodyweight management by body weight perception

Table 22 shows that, in general, there is not any significant difference in weight control behaviours between participants who perceived themselves correctly as overweight or not. The only exception was that individuals who had surgery seem to be more likely not precisely perceive themselves.

**Table 22.** Weight control behaviours by weight perception.

|   | Correct perception of overweight | Misperception of overweight | <i>P</i> value |
|---|----------------------------------|-----------------------------|----------------|
| Diet (n=184)                            | 52.2                             | 65.1                        | 0.064          |
| Physical activity (or exercise) (n=134) | 48.1                             | 50.8                        | 0.13           |
| Herbs and mixtures (n=32)               | 12.1                             | 8.3                         | 0.45           |
| Medication (n=9)                        | 3.5                              | 2.1                         | 0.62           |
| Surgery (n=35)                          | 10.3                             | 21.2                        | 0.031          |

## 6. Conclusion

The current study showed to which extent the nutrition and epidemiological transitions have affected all age groups. The health authorities are urged to intervene in order to halt the progression of chronic non-communicable diseases and to reduce the impact of health risk factors. The life course approach highlighted the impact of early life experiences (including unhealthy eating behaviours) on individual health during the adulthood [21, 22]. Moreover, because risky factors acquired during the early phases of life tend to track back to adulthood and later on [23], the conduction of public health interventions during childhood and adolescence are at the most importance.

## 7. References

1. Zaghoul S, Al-Hooti SN, Al-Hamad N, Al-Zenki S, Alomirah H, Alayan I *et al.* Evidence for nutrition transition in Kuwait: over-consumption of macronutrients and obesity. *Public Health Nutr*2013 Apr;16(4):596-607.
2. Alhamad N, Almalt E, Alamir N, Subhakaran M. An overview of salt intake reduction efforts in the Gulf Cooperation Council countries. *Cardiovasc Diagn Ther*2015;5(3):172-77.
3. Nations U. Human Development Report 2020—the Next Frontier: Human Development and the Anthropocene. The United Nations Development Programme New York, NY; 2020.
4. Hashem R, Rey-López JP, Hamer M, McMunn A, Whincup PH, Owen CG *et al.* Physical Activity and Sedentary Behaviors Levels of Kuwaiti Adolescents: The Study of Health and Activity Among Adolescents in Kuwait. *J Phys Act Health*2018 Apr 1;15(4):255-62.
5. Al-Baho AK, Al-Naar A, Al-Shuaib H, Panicker JK, Gaber S. Levels of physical activity among Kuwaiti adults and perceived barriers. *The Open Public Health Journal*2016;9(1).
6. Alqaoud N, Al-Jawaldeh A, Al-Anazi F, Subhakaran M, Doggui R. Trend and Causes of Overweight and Obesity among Pre-School Children in Kuwait. *Children (Basel)*2021 Jun 19;8(6).
7. Organization WH. Strategy on nutrition for the Eastern Mediterranean Region 2020–2030. 2019.
8. Oguoma VM, Coffee NT, Alsharrah S, Abu-Farha M, Al-Refaei FH, Al-Mulla F *et al.* Prevalence of overweight and obesity, and associations with socio-demographic factors in Kuwait. *BMC Public Health*2021 Apr 7;21(1):667.
9. Al-Taiar A, Alqaoud N, Hammoud MS, Alanezi F, Aldalmani N, Subhakaran M. WHO infant and young child feeding indicators in relation to anthropometric measurements. *Public Health Nutr*2020 Jul;23(10):1665-76.
10. AlRodhan Y, AlAbdeen Y, Saleh E, AlFodari N, AlSaqer H, Alhumoud F *et al.* Obesity and maternal perception: a cross-sectional study of children aged 6 to 8 years in Kuwait. *East Mediterr Health J*2019 Oct 4;25(7):465-72.
11. Al-Isa AN, Campbell J, Desapriya E. Factors Associated with Overweight and Obesity among Kuwaiti Elementary Male School Children Aged 6-10 Years. *Int J Pediatr*2010;2010.
12. Alkandari A, Alarouj M, Elkum N, Sharma P, Devarajan S, Abu-Farha M *et al.* Adult Diabetes and Prediabetes Prevalence in Kuwait: Data from the Cross-Sectional Kuwait Diabetes Epidemiology Program. *J Clin Med*2020 Oct 25;9(11).
13. Rodriguez-Martinez A, Zhou B, Sophiea MK, Bentham J, Paciorek CJ, Iurilli MLC *et al.* Height and body-mass index trajectories of school-aged children and adolescents from 1985 to 2019 in 200 countries and territories: a pooled analysis of 2181 population-based studies with 65 million participants. *The Lancet*2020 2020/11/07;396(10261):1511-24.

14. WHO. Indicators for assessing infant and young child feeding practices: Definitions and measurement methods. 2021.
15. WHO. WHO child growth standards: training course on child growth assessment. 2008.
16. WHO. WHO child growth standards: length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age: methods and development: World Health Organization; 2006.
17. Organization WH. WHO. Indicators for assessing infant and young child feeding practices: conclusions of a consensus meeting held 6-8 November 2007 in Washington DC, USA [Internet]. Geneva: World Health Organization; 2008 [cited 2016 Jul 19]. 19 p. 2015.
18. WHO. WHO Child Growth Standards: Methods and development: Length/height-for-age, weight-for-age, weight-for-length, weight-for-height and body mass index-for-age. World Health Organization Geneva; 2006.
19. Onis Md, Onyango AW, Borghi E, Siyam A, Nishida C, Siekmann J. Development of a WHO growth reference for school-aged children and adolescents. Bulletin of the World health Organization 2007;85:660-67.
20. Organization WH. Anthro for Personal Computers, Version 3.1. Software for Assessing Growth and Development of The World's Children. Geneva (Switzerland), WHO, 2010. 2021.
21. Mitchell PJ, Cooper C, Dawson-Hughes B, Gordon CM, Rizzoli R. Life-course approach to nutrition. Osteoporos Int 2015;26(12):2723-42.
22. Jacob CM, Baird J, Barker M, Cooper C, Hanson M. The importance of a life course approach to health: chronic disease risk from preconception through adolescence and adulthood. World Health Organization 2017;41.
23. Movassagh EZ, Baxter-Jones ADG, Kontulainen S, Whiting SJ, Vatanparast H. Tracking Dietary Patterns over 20 Years from Childhood through Adolescence into Young Adulthood: The Saskatchewan Pediatric Bone Mineral Accrual Study. Nutrients 2017;9(9):990.