

Method for the preparation of a reconstituted beverage

Introduction

This invention relates to a method for the preparation of a serving of a reconstituted beverage for a subject, preferably a human. The beverage is reconstituted from a formula product and a liquid. The invention also relates to a computer program executable on a computer (100) for assisting the preparation of reconstituted beverage in a feeding container wherein the ratio (40) between the desired amount of the formula product (10) and the desired amount of liquid (30) is determined using the method of the invention; and to a computer running said program. Further, the invention relates to a system for assisting in the preparation of a beverage.

Background

Breastfeeding is the best way to ensure healthy growth and development of infants during the first months of life. When mothers cannot or choose not to breastfeed, an alternative for breast milk is needed. High-quality foods for infants and young children are available that are safe and scientifically developed according to their nutritional needs. Still there is an ongoing need to further improve alternative solutions to breast milk. Such improvements may come for example from new compositions, composition preparation methods or administration procedures.

US2015/088304 relates to an apparatus for providing metered amounts of ingredients to a nutritional composition for use in administration to an infant. CN212037204U relates to a milk brewing system based on voice and humidity recognition.

CN112951367A relates to a newborn venous nutrition monitoring system and method.

J Agren *et al* have described fluid management considerations in extremely preterm infants born at 22-24 weeks of gestation (J. Agren *et al* // Seminars in Perinatology 46 (2022) 151541).

L. Nonato and C. Lund have described measuring techniques and research recommendations relating to water loss in the intensive care nursery of premature newborns (L. Nonato and C. Lund, Newborn and infant nursing reviews, Vol 1, No 1 2001 pp 11-20).

Formula products, such as infant formula, are prepared by admixing a fixed amount of liquid such as (warm) water, with a corresponding amount of formula product. The ratio between the amount of liquid and formula product is fixed and is well-explained on the package of the formula product, for example three scoops of 14 gram of infant formula product per 90 mL of water providing 100 mL of ready to serve product.

The hydration needs of children are not that different to those of adults. However, infants and children are more susceptible to dehydration than adults. The values for total water intake for infants and children under conditions of moderate environmental temperature and moderate physical activity levels may vary. For example infants aged 0-6 months require 100-190 mL/kg/day where the liquid is coming from human milk/infant formula. Infants aged 6-12 months: 0.8-1.0 L/day - the liquid is coming from human milk/infant formula and complementary foods and beverages. The water intake for infants aged 1-2 years is 1.1-1.2 L/day, for children aged 2-3 years: 1.3 L/day and for children 4-8 years: 1.6 L/day.

Compared to children and adults, infants have a higher total body water content. In newborns the total body water content can be as much as 75% and this decreases to 50-60% by the time they reach adulthood. Infants and children need water not only to replace the losses via respiration, sweating and urine, but also for growth. Instances of diarrhea and vomiting are frequent in infants and young children and both can lead to dehydration if water losses are not replaced. Infants cannot easily communicate their needs and active children can be so involved in what they are doing that they forget to drink, so it is important for those caring for them to be alert to the possibility of dehydration especially during hot weather or during periods of illness. Risks of dehydration are also present when the air humidity is high, such as above 60%, in particular above 70%.

Iris Iglesia *et al* have shown that a high proportion of children and adolescents are at risk of an inadequate fluid intake. This risk is especially high in males and adolescents when compared with females or children categories, highlighting water intake among young populations as an issue of global concern (I. Iglesia et al 2015 Eur. J. Nutr. 54 Suppl (2):S57-S67 DOI:10.1007/s00394-015-0946-6).

Infant fluid loss is approximated by five mechanisms in the body: fluid loss by evaporation from the skin (trans epidermal water loss) and lungs (respiratory water loss), sweating, fecal water loss and urine water loss.

5 Respiratory water loss (RWL)

Breathing causes fluid loss i.e. water loss, through exchange between the lung epithelium and the inhaled air. The loss depends at least on breathing volume, body temperature, outside temperature, altitude and humidity of inhaled air. The breathing rate changes as the baby develops. The respiratory rate of a newborn is 30 - 60
 10 breaths per minute. Though in rest, the number of breaths per minute is assumed to decrease linearly from 35 breaths per minute at age of 0 weeks to 30 breaths per minute at 52 weeks. Obviously, breathing volume increases as the baby grows. The breathing volume scales linearly with the weight of the baby with the value of 6 mL/kg. This allows to calculate the baby's ventilation in mL/min. The respiratory water
 15 loss also depends on the pressure gradient across the lung epithelium and may hence be formulated as:

$$RWL = 0.0008 * ventilation * [(47.0 - VP_{air}) / barometerpressure] \quad [mL/min]$$

Wherein ventilation is the ventilation of the subject (baby); 47.0 is the water vapor pressure at 37 degrees Centigrade and VP_{air} is the aqueous vapor pressure at the
 20 location of the baby.

Alternatively, the RWL may be determined using a flow-through system (Sedin and Ågren, Upsala J Med Sci 111 (1): 45–60, 2006). This system showed that RWL in newborn term infants at rest is 4.9 mg/kg • min, wherein kg is referring to the kg body weight. It further discloses that RWL depends on the temperature and humidity of the
 25 inspired air and on the respiratory rate, tidal volume, dead space ventilation and the ability of the nose to dehumidify and cool expired air. RWL increases with increasing activity in term infants: 4.9 mg/kg • min (asleep, no motor activity), to 5.5 (asleep minor motor activity), to 6.2 (awake, quiet no motor activity), to 7.0 (awake, quiet, active), to 8.0 (awake, crying, active), to 10.8 (awake, furiously crying).

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Urinary water loss (UWL)

The capacity of the kidneys to reabsorb water into the blood stream develops over time after birth. Newborns cannot reabsorb water to the same extend as adults. They are not able to concentrate the urine to the same level as adults.

The daily obligate urinary water loss is determined by the renal solute load and the concentrating ability of the child's kidneys. The renal solute load consists primarily of urea and major electrolytes (Na, K, Cl); under usual conditions this is approximately 15 mOsm/100 Cal. Enough water should be provided for urine formation to avoid the need to either concentrate or dilute the urine, yielding a urine which is nearly isotonic with plasma. Therefore obligate renal water loss is equal to "normal renal solute load" / "desired urine concentration". A full term infant needs to excrete a solute load of about 15 mosm/kg/day in the urine. To excrete this solute load at a urine osmolarity of 300 mosm/kg/day the infant would have to pass a minimum of 50 ml/kg/day (Aggarwal et al Indian J Pediatr 2001 68(12):pp 1139-42. doi: 10.1007/BF02722931. Fluid and electrolyte management in term and preterm neonates). Urinary water loss may be determined by measuring the amount of urine produced per day.

15 **Trans epidermal water loss (TEWL)**

Trans epidermal water loss (TEWL) is the normal, constitutive loss of water vapor from the skin in the absence of sweat gland activity. It is regarded as one of the most important parameters for characterizing skin barrier function, and the values are dependent on multiple variables. TEWL through the infant skin is higher than through adult skin, due to skin maturation. TEWL is dependent on age, weight, skin temperature, ambient temperature, relative humidity and altitude. As of an age of 1 year, the TEWL is stable in mL/ min per surface area unit and hence increases linearly with the body surface area. For an average 1 year old, the TEWL is 0.37 mL/min, which corresponds to 0.09 mL/min per square feet surface area.

25 Independent from the skin maturation, TEWL is dependent on ambient relative humidity (RH) and is given as a diffusion equation: $TEWL = K (VP_s - VP_{air})$ where K is a permeability constant, VP_s is the vapor pressure of water at skin surface temperature and VP_{air} is the aqueous vapor pressure of the air.

30 The relationship of trans epidermal water loss to rising ambient humidity is not linear. With increasing humidity the TEWL rises until at about 30- 50% RH. At higher RH it is reduced. The TEWL is not greatly affected by ambient humidity: there is only a 2- 3 fold increase when the RH is raised from 2- 3 to 30-50%. (Grice et al, The Journal of Investigative Dermatology Volume 58, Issue 6, June 1972, Pages 343-346;

<https://doi.org/10.1111/1523-1747.ep12540526>). They reported an TEWL (mg/cm²/hr) of 0.36 at Relative Humidity of 2.6; of 0.58 at RH of 25.0; of 0.47 at RH of 49.0; of 0.30 at RH of 76.0 (average of 12 subjects).

- 5 Fluhr et al have reported a high TEWL in the first 4 h after birth, and afterwards returned to values of 6 g m⁻² h⁻¹, suggesting ongoing desiccation of the skin immediately after birth. There is a wide agreement that basal TEWL values in non-stressed skin in term newborns is below 10 g m⁻² h⁻¹, which is similar to that in healthy adults. (J.W. Fluhr et al British Association of Dermatologists 2012 166, pp483–490, DOI 10.1111/j.1365-2133.2011.10659.x). TEWL may be measured using
10 the method as described by Fluhr et al, i.e. essentially by using both volar forearms, acclimatizing them least 30 min in an air-conditioned room at the desired temperature e.g. 20 ± 2 °C and humidity e.g. 50 ± 10% , with the test area uncovered by clothing; using an open chamber device, using a Tewameter (i.e. a measuring device for the
15 assessment of the trans-epidermal water loss (TEWL) such as the TM 300; Courage & Khazaka, Cologne, Germany). Measurements of the TEWL , at each site until a stable value for TEWL is reached.
- TEWL may be influenced by isolation of the subject e.g. by clothing. Clothing being a temperature isolation between the body and the surroundings. As such, clothing may
20 cause the actual ambient temperature to be closer to the body temperature.

Sweat water loss (SweatWL)

- Sweat (or perspiration) is the human body's physiological response to high temperatures, and is an attempt to lower body temperature through evaporation of
25 sweat. Maximum sweat rates of an adult can be up to 2–4 liters per hour or 10–14 liters per day (10–15 g/min·m²), but is less in children prior to puberty. Maximum sweat rates depend among other on the genetic make-up an individual. For example, a variation in the EDAR370A gene has been reported to change teeth, improve sweating capabilities by changing sweat glands, and change hair density and
30 thickness. Under high air temperature and humidity conditions, the effect of perspiration is hindered due to reduced evaporation as a result of high humidity. When evaporation is hindered, overheating and dehydration can occur, with varying severity. The amount of clothing will also affect this cooling efficiency due to its restriction of the air flow over the skin.

The ability to sweat develops within 2 weeks after birth and it develops during the first year of life of an infant. There has been found in research that infants are only able to sweat when body temperature rises above 37.1 degrees Celsius or when ambient temperature rises above 34 degrees.

- 5 The sweat loss may be calculated as the energy needed to lose to maintain a stable core and skin temperature in the infant. The “skin temperature increase” is defined by the amount of kCal (or kilo Joule) of energy created by metabolism in the body (E metabolism) that is not lost via cooling mechanisms. Cooling mechanisms include radiation, conduction (E con;rad), evaporation of trans epidermal water loss (E
- 10 TEWL), E loss via respiratory system (E lung) and sweating (E sweat). As such, the Energy loss via sweating E sweat may be defined as:

$$E_{\text{sweat}} = E_{\text{metabolism}} - E_{\text{lung}} - E_{\text{TEWL}} - E_{\text{urine}} - E_{\text{con;rad}}$$

- E lung is defined as the energy lost via water loss as liquid and vapor; and the heat lost to the air. E con;rad (radiation and conduction) is defined as the heat lost by
- 15 passing air; hence it is dependent on the temperature difference between skin and environment; it can cause the body to cool down or to warm up. E lung, E TEWL, E urine, E con;rad and E sweat are all positive numbers, as is clear from the formula given above.

- Further, it is assumed that sweating does not occur at an environment temperature of
- 20 20 degrees Centigrade or below, hence, at 20 degrees Centigrade or below, E sweat is equal to 0. Consequently, there is no water loss via sweating at temperatures of 20 degrees Centigrade or below. Using the energy calculation as given above, the sweat loss in mL per day was calculated to vary between 50 mL to 1.3 L going from an age of 2 weeks to 1 year and depending on the temperature varying between 30
- 25 and 35 degrees Centigrade.

- Alternatively, the SweatWL may be determined using other methods known in the art. Air humidity influences sweating levels, in hot climates water loss is higher with increasing air humidity because a high humidity reduces sweat evaporation speed from the body. As a consequence, the body will produce more sweat which results in
- 30 higher water losses. Low air humidity causes sweat to evaporate fast thereby effectively cooling the body. Consequently, a low air humidity causes less sweat production.

Sweating may be influenced by clothing in a similar way as TEWL.

Fecal Water Loss (FWL)

Normally, the water loss via feces is limited. Still, EFSA has published a paper on dietary reference values for water, indicating that Fecal Water Loss (FWL) under normal conditions are quite small and amount to 100 to 200 mL/day in adults. In
5 healthy infants, fecal water losses of 10 mL/kg body weight per day are assumed. With diarrhea this can increase 5 to 8 times (EFSA Panel on Dietetic Products, Nutrition, and Allergies (NDA); Scientific Opinion on Dietary reference values for water. EFSA Journal 2010; 8(3):1459. [48 pp.]. doi:10.2903/j.efsa.2010.1459.).

10 Balance between water intake and water losses

The minimum water requirement for any individual in a defined condition is the amount of water that equals losses and prevents adverse effects of insufficient water, such as hypohydration. Adding up the water losses described above, total water
15 intakes of between 1,400 mL in a sedentary adult and up to 12,000 mL in an active adult at high temperature have been reported. A diet providing an osmotic solute load of 1,500 mosm, and with reduced capacity to concentrate urine above 400 mosm/L, water would be needed to balance losses. Under temperate conditions without excessive muscular workload, the most important factors which determine the individual water requirement will be the diet and its osmotic solute content and the
20 concentrating capacity of the kidneys. For safety concerns it appears prudent not to base this calculation on the maximum concentrating capacity of the kidneys, but to target the water intake recommendation to a urine osmolarity of about 500 mosm/L water in order to provide a safe margin of a —free water reserve.

Alternatively, one can relate energy intake to water intake and to achievable or
25 desirable urinary osmolarity and to recommend water intakes per unit of energy consumed. Western European countries advise total water intakes of 1 mL/kcal in adults and of slightly higher values in the elderly and of 1.5 mL/kcal in infants. The latter two groups are known to have a lower concentrating ability of the kidneys. (EFSA Panel on Dietetic Products, Nutrition, and Allergies (NDA); Scientific Opinion
30 on Dietary reference values for water. EFSA Journal 2010; 8(3):1459. [48 pp.]. doi:10.2903/j.efsa.2010.1459.).

The effect of radiation is important under all temperature conditions. Excess radiation always acts to increase the heat load on a person. This can be of assistance under cold conditions, but under hot conditions it is an extra heat load that must be shed. Airconditioning or climate control in houses and buildings may generate an airflow
5 which is normally less humid as compared to the outside temperature. Consequently, if the expected water loss and/or human thermal comfort is based on the actual outside weather conditions or forecast, the expected water loss may need to be adjusted for the presence of climate control.

10 Air humidity may vary a lot, particularly between different geographical locations or due to climate control such as air-conditioning. High humidity worsens the risk of high temperatures as sweating is less effective in lowering the body temperature. In the context of this invention, the relative air humidity is considered high if it is above 60%, in particular if it is above 70%.

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When a person e.g. an infant, child or adult drinks more water than needed, this will fill up the stomach and hence reduce the desire to take other food. This may lead to under nutrition / weight loss which is generally undesirable for infants, children and some adults.

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Accordingly, there is a need for ways to control the intake of the right amount of liquid especially of water, and the right amount of nutrients, especially the intake of formula such as infant formula, follow on formula, or growing up milk. There further is a need to compensate the excess water loss of a subject which may be caused by one or
25 more of respiratory water loss, urinary water loss, fecal water loss, trans epidermal water loss and/or sweat water loss. Compensating the excess water loss causes an improved water balance in a subject and/or prevents dehydration and/or reduces a mineral overload of the renal system.

The inventors surprisingly found that by varying the ratio between the recommended
30 amount of formula product and the corresponding amount of liquid dependent on the Excess Water Loss of the subject, one or more of the above-mentioned problems may be solved.

Summary of the invention

Accordingly, the invention relates to the method, computer program and system as defined in the claims.

In one aspect, the invention relates to a method for the preparation of a beverage,
5 preferably an infant formula, for a subject from a formula product (10) comprising the steps of

- i. obtaining the formula product (10) with a default ratio (40) wherein the formula product (10) needs to be mixed with a liquid (30) and with a recommended daily intake of beverage and a corresponding "Daily amount
10 of liquid" and "Daily amount of formula product";
- ii. determining the total water loss (TWL) of the subject using three or more of the Respiratory Water Loss (RWL), the Urinary Water Loss (UWL), the Fecal Water Loss (FWL), the Trans Epidermal Water Loss (TEWL), and Sweat Water Loss (SweatWL);
- 15 iii. calculate the Excess Water Loss (EWL) as $TWL - SWL$ for the subject,
- iv. adjusting the default ratio (40) if EWL is larger than 0 mL/day;

wherein the adjustment of the ratio (40), i.e. "adjusted ratio", corresponds to an increase in the Daily amount of liquid with the EWL +/- 10% while keeping the Daily amount of formula product constant;

20 wherein the SWL (Standard Water Loss) is equal to the Daily amount of liquid.

In another aspect the invention relates to a computer program executable on a computer (100) for assisting in the preparation of reconstituted beverage in a feeding container (20), wherein the computer program is configured to:

- a) store at least one personal subject profile comprising information related to
25 an identified subject;
- b) store at least one set of preparation instructions for at least one formula product (10);
- c) pair at least one formula product selected from a group consisting of one or more formula products (10.1, 10.2, 10.3, 10.4, ..., 10.x) with the stored
30 subject profile;
- d) compute from the pairing of the formula product and stored subject profile, a coaching instruction set by determining preparation information, the coaching instruction set comprising a desired amount of the formula product (10) and a desired amount of liquid (30);

wherein the ratio (40) between the desired amount of the formula product (10) and the desired amount of liquid (30) is determined using the method of the invention.

In still another aspect the invention relates to a system for assisting in the preparation
5 of a reconstituted beverage in a feeding container (20) comprising a computer
program according to the invention and hosted on a computer and an electronic
device (200), the device being arranged to communicate with the computer and
being arranged for controlling operations of the formula preparation according to the
received coaching instruction set communicated by the computer device wherein the
10 electronic device (200) is comprising a weighing unit with a user interface (213), a
control unit and a communication module arranged to communicate with a computer
(100) hosting the computer program according to any one of claims 11 to 13 wherein
the device comprises a coaching program (CP) configured for selecting a subject
profile and controlling operations of the formula preparation according to
15 i) the coaching instruction set received from the computer device resulting
from the pairing of the selected subject profile and an formula product
selected from a plurality of infant formula products (10.1, 10.2, 10.3,
10.4, ..., 10.x); and
ii) the EWL of the subject or the expected EWL of the subject;
20 preferably wherein the electronic device (200) is an electronic scale.

Definitions

As used herein the term "reconstituted beverage" relates to a drinkable product that
is prepared by dissolving a powder in a liquid such as dissolving an infant formula in
25 water. The drinkable product has a viscosity of less than 200 cP (at 25 °C and a
pressure of 1 atmosphere) such as between 1 and 100 cP. Methods to determine
viscosity are well-known in the art just like references for calibration. For example
water has a viscosity at 25 °C and a pressure of 1 atmosphere of 0.891 cP and soya
bean oil of 60 Cp.

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A formula product (10) as used herein refers to a product which upon reconstitution
with a liquid, preferably with water, more preferably boiled water, provides a
reconstituted drinkable product. The formula product usually is a powder, although in
some instances it may be readily dissolvable tablet or cube. Examples of formula

products include products that after reconstitution into a reconstituted beverage provide a complete nutrition for a subject such as IFT products, Follow-on-Formula (FOF), and JrGUM products. Alternatively, the formula product provides minerals and optionally lactose and is substantially free of protein and fat. Each formula product
5 (10) has a recommended dosage (i.e. amount) of formula product per subject per day; a recommended number of feeding moments per subject per day and a recommended ratio (40) between the desired amount of the formula product (10) and the desired amount of liquid (30).

A reconstituted beverage from a formula product is prepared by admixing a fixed
10 amount of liquid, preferably (warm) water, with a corresponding fixed amount of formula product i.e. recommended ratio or advised ratio or default preparation ratio, or normal value. Once the reconstituted beverage is consumed, its temperature should not be too high in order to avoid burning of the subjects tongue or mouth. Hence normally the temperature of the liquid should be 37 °C or below. An
15 adaptation of a serving of a reconstituted beverage is a change in the powder to liquid ratio as compared to the recommended ratio.

A “specific human” as used herein, is the human subject the reconstituted beverage is prepared for. In the preparation of the reconstituted beverage, the ratio (40)
20 between the desired amount of the formula product (10) and the desired amount of liquid (30) is dependent on the EWL of the human subject.

As used herein, “water intake” is the sum of water in food and beverages plus metabolic water; “water output” is the sum of water losses by the lung, skin, intestine
25 and kidney.

Details of the invention

In one aspect, the invention relates to a method for the preparation of a beverage, preferably an infant formula, for a subject from a formula product (10) comprising the
30 steps of

- i. obtaining the formula product (10) with a default ratio (40) wherein the formula product (10) needs to be mixed with a liquid (30) and with a recommended daily intake of beverage and a corresponding

“recommended Daily amount of liquid” and “recommended Daily amount of formula product”;

- ii. determining the total water loss (TWL) of the subject using three or more of the Respiratory Water Loss (RWL), the Urinary Water Loss (UWL), the Fecal Water Loss (FWL), the Trans Epidermal Water Loss (TEWL), and Sweat Water Loss (SweatWL);
- iii. calculate the Excess Water Loss (EWL) as $TWL - SWL$ for the subject,
- iv. adjusting the default ratio (40) if EWL is larger than 0 mL/day;

wherein the adjustment of the ratio (40), i.e. “adjusted ratio”, corresponds to an increase in the recommended Daily amount of liquid with the EWL $\pm 10\%$ while keeping the recommended Daily amount of formula product constant; wherein the SWL (Standard Water Loss) is equal to the Daily amount of liquid. As used herein, the ratio (40) is equal to the default ratio wherein the formula product (10) needs to be mixed with a liquid (30), this is equal to the ratio between “recommended Daily amount of formula product” divided by “recommended Daily amount of liquid”.

The TWL is preferably given in milli liter per day (mL/day). The beverage being prepared in the method of the invention may also be referred to as a reconstituted beverage as it is reconstituted from a powder and a liquid.

For the avoidance of doubt, the volume of the recommended daily intake of beverage corresponds to the “daily amount of liquid”. The person skilled in the art of infant nutrition is aware that infant formula needs to be mixed with water. Usually, one scoop of formula needs to be mixed with 30 mL of water and one scoop normally provides between 4 and 5 gram of infant formula, such as for example 4.2 g per scoop. In this example the default ratio (40) would be 4.2 g per 30 mL and such a ratio is predetermined by the supplier of the formula product (10) as described elsewhere herein. The amount per scoop is depending on the brand and type of formula. The method of the invention can be executed by a person, such as a caregiver of the subject, prior to preparing the beverage. In that way, an adjusted ratio (40) as determined in step iv) may be used for the preparation of the beverage thereby compensating for an excess water loss (EWL) if present. An increase in the recommended “Daily amount of liquid” with the “EWL $\pm 10\%$ ” while keeping the recommended Daily amount of formula product constant is illustrated by the following. Suppose a subject has a recommended daily amount of liquid of 180 mL

per day (e.g. six portions of 30 mL) and each portion of 30 mL contains one scoop of 4.2 g. Then the "daily amount of formula product" would be 25.2 g (6 x 4.2g) and the default ratio (40) would be 4.2 g/ 30 mL (= 25.2 g / 180 mL). If the excess water loss (EWL) is determined to be 40 mL per day, then the adjustment of default ratio (40) is
5 determined as 25.2 g / (180 + 40) mL In addition the +/- 10% may be applied to the +40 mL resulting in an adjusted ratio being between 25.2 g/ 224 mL and 25.2 g/ 216mL.

In one embodiment the TWL of the subject is determined using RWL and one or more of UWL, FWL, TEWL, and SweatWL; in another embodiment TWL is
10 determined using UWL and one or more of RWL, FWL, TEWL, and SweatWL; or alternatively, TWL is determined using FWL and one or more of RWL, UWL, TEWL, and SweatWL; in yet another embodiment TWL is determined using TEWL and one or more of RWL, FWL, UWL, and SweatWL; or alternatively, TWL is determined using SweatWL and one or more of RWL, FWL, UWL, and TEWL.

15 In one embodiment the TWL of the subject is determined using RWL and two or more of UWL, FWL, TEWL, and SweatWL; in another embodiment TWL is determined using UWL and two or more of RWL, FWL, TEWL, and SweatWL; or alternatively, TWL is determined using FWL and two or more of RWL, UWL, TEWL, and SweatWL; in yet another embodiment TWL is determined using TEWL and two
20 or more of RWL, FWL, UWL, and SweatWL; or alternatively, TWL is determined using SweatWL and two or more of RWL, FWL, UWL, and TEWL.

Preferably TWL is determined using RWL, UWL, FWL, and TEWL; or using RWL, UWL, FWL, and SweatWL; or using RWL, UWL, TEWL, and SweatWL; or using RWL, FWL, TEWL, and SweatWL; or using UWL, FWL, TEWL, and SweatWL.

25 More preferably, TWL is determined using RWL, UWL, FWL, TEWL and SweatWL. In one embodiment, the adjusted ratio is at least 3%; preferably at least 5%, more preferably at least 10 %, even more preferably at least 15% below the default ratio (40). In other words, the amount of liquid (e.g. water) as compared to a given amount of formula product (10) is increased with at least 3%; preferably at least 5%, more
30 preferably at least 10 %, even more preferably at least 15%.

In one embodiment, the subject is a human subject, preferably in another embodiment, a human subject between 0 and 5 years old, more preferably between 0 and 3 years old, even more preferably between 0 and 12 months old.

The formula product (10) having a recommended dosage of formula product per subject per day, the formula product (10) having a recommended number of feeding moments per subject per day and a recommended ratio (40) between the desired amount of the formula product (10) and the desired amount of liquid (30). Such recommended values, which are herein also referred to as "desired amount" are provided by the supplier of the formula product and may depend on the type of product and the age of the subject. For example, the recommended values for a subject of 14 months may be 4 times 27 gram of formula product dissolved in 180 mL of water. In one embodiment of the method of the invention, the ratio (40) between the desired amount of the formula product (10) and the desired amount of liquid (30) is amended based on the EWL of the subject and the number of recommended feeding moments is increased, while maintaining the recommended dosage of formula product per subject per day.

In one embodiment of the method of the invention, the EWL of the specific subject is increased with the amount of reconstituted beverage i.e. reconstituted beverage, not being consumed from one or more meals in the preceding 24 hours. For example, if a subject did not consume 20 mL of the last serving, the EWL is increased with 20 mL for the next serving to compensate for the lower intake of formula product. This is particularly relevant if the subject failed to consume the normal amount of formula product (10) for two or more servings in a row and if the amount of reconstituted beverage consumed in one serving (50) is less than 80 % of the recommended serving size. So, in one embodiment, if the subject failed to consume the normal amount of formula product (10) for two or more servings in a row and if the amount of reconstituted beverage consumed in each one serving (50) is less than 80 % of the recommended serving size the EWL is increased with at least 10 mL, preferably with 20 mL.

As this invention is not linked to a specific formula product, the skilled person will understand that the recommended amount of formula product per serving and the ratio (40) between the desired amount of the formula product (10) and the desired amount of liquid (30), depends on the formula product. These amounts may be obtained from the package of the formula product or from the supplier of the formula product. The gist of the invention is that this recommended ratio (40) is made dependent on the EWL of the subject receiving the reconstituted beverage. In

particular the relative amount of liquid to formula product is increased when the EWL of the subject is more than 10mL preferably more than 20 mL, more preferably more than 30 mL even more preferably more than 50 mL, in other words, the subject is in a state of hypohydration.

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Since infants and children are less able to indicate if they are thirsty, the formula product preferably is a food product for children. Alternatively, the formula product is an infant formula product. Preferably, the formula product is a food product for children aged 0 to 36 months more preferably 1-36 months, such as an infant formula product (0-6 months), a follow on formula (6-12) or junior GUM product (12-36 months).

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Likewise, elderly or diseased people may be less able to self-assess their hydration status and indicate if they are thirsty or not, in other words if they are in euhydration hyperhydration or hypohydration state. So, in one embodiment the formula product is an adult nutrition product.

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Preferably, the subject in the method of the invention is a human subject, preferably a human subject between 0 and 5 years old, more preferably between 0 and 3 years old, even more preferably between 0 and 12 months old.

Accordingly, in one embodiment the formula product (10) is selected from a group consisting of one or more formula products (10.1, 10.2, 10.3, 10.4, ..., 10.x). This allows for a selection of an appropriate formula product 10 matching the nutrient needs of the subject. For example, formula product 10.1 may be a first IFT formula, formula product 10.2 a second IFT product (e.g. an anti-reflux IFT product), formula product 10.3 a first Follow-on-Formula (FOF) and formula 10.4 a JrGUM.

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Formula products normally contain all nutrients needed by a subject. The only thing the customer has to do is to reconstitute a beverage from the formula product with a liquid. Preferably this liquid is water, more preferably drinking water. The water may be boiled prior to use in order to destroy pathogenic bacteria, yeast and fungi which may be present in the water.

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In another embodiment, input parameters a) - f) are used to determine one or more of TWL, RWL, UWL, FWL, TEWL, SweatWL and EWL; wherein a) – g) are defined as

a). Temperature [e.g. in degrees Centigrade], b). Relative Humidity [%], c). Air Pressure [mBar], d). age of the subject, e). weight of the subject, f). height of the subject, and g). Growth curves. Preferably, 2 or more input parameters are used, such as 3, 4, 5, 6, or 7. More preferably 4 or more input parameters are used. Even
5 more preferably all input parameters a) to g) are used. Input parameter a) Temperature may be measured using a thermometer, b) relative humidity may be determined using a hygrometer. The air pressure (c) may be measured using a suitable sensor like a barometer. Likewise, the weight e) and height of the subject may be measured using methods known in the art. The growth curves (input
10 parameter g) may be obtained from the World Health Organization (WHO) and includes length / height for age and weight for length/height curves for girls and boys of different ages. These can be downloaded from who.int under tools/child-growth-standards/standards. In yet another embodiment of the method according to the invention, the RWL is determined using the weight of the subject and the Air
15 Pressure [mBar]; the UWL is determined by measuring the amount of urine produced per day by the subject, the FWL is determined using the weight of the subject; the TEWL is determined using the temperature, relative humidity [%], the age of the subject, and the weight of the subject; and the SEWL is determined using the temperature and relative humidity [%].

20

The skilled person will understand the need to apply the method of the invention becomes more relevant as EWL increases. So in one embodiment the EWL is more than 20 mL per day, preferably more than 40 mL per day, more preferably more than 60 mL per day, even more preferably more than 80 mL per day.

25

In one embodiment, the ratio (40) between the desired amount of the infant formula product (10) and the desired amount of liquid (30) is decreased, in other words, a specific amount of formula product is dissolved in a larger amount of liquid than the recommended amount. The decrease being at least 3%, such as 4%, 5%, 6%, 7%,
30 8%, 9%, 10%, 11%, 12%, 13%, 14%, 15% or even at least 20% such as at least 25%, 30%, 40% or even 50%; preferably wherein the decrease of the ratio (40) is at least 5%, more preferably at least 10 %, even more preferably at least 15%. The decrease of the ratio (40) is preferably less than 75%, more preferably less than

50%. In another embodiment the decrease of the ratio (40) as compared to the normal value is selected from the group consisting of 5%, 10%, 15%, 20% and 25%. As used herein, changes in the ration between the desired amount of the formula product (10) and the desired amount of liquid (30), are expressed relative to the
5 normal or recommended ratio between formula product and liquid.

The EWL may include the total combination of food and drinks a subject is consuming, especially if the subject is eating and drinking other food than the reconstituted beverage. For formula-fed young children and in particular for formula-
10 fed infants, the only food and liquid consumed is the infant formula optionally supplemented with small amounts of fruit or other food. Accordingly, in another embodiment of the invention, the ratio (40) between the desired amount of the (infant) formula product (10) and the desired amount of liquid (30) as defined in the method of the invention, is additionally depending on other food the subject is
15 consuming. In case the other food is providing a lot of liquid, that will have an influence on the EWL of the subject, the same if the other food is predominantly of a dry nature. Hence, preferably the default ratio (40) in the method of the invention is increased when the dry matter content in the other food is 30 wt% or lower, such as 25wt% or lower. Alternatively preferably, default ratio (40) is increased when the dry
20 matter content in the other food is 20wt% or lower, such as 15wt% or lower; more preferably wherein the default ratio (40) is increased when the wt% of dry matter in the other food is 10% or lower; most preferably wherein the default ratio (40) is increased when the wt% of dry matter in the other food is 5% or lower. The total food as used herein is defined as all other food and drinks the subject has consumed in
25 the 12 hours preceding the administration of the reconstituted beverage and is expected to consume in the 12 hours after the administration of the reconstituted beverage.

In still another embodiment, the EWL as defined and calculated in step iii in the
30 method of the invention, additionally depends on the actual amount of reconstituted beverage consumed during the 12 or 24 hours, preferably in the 24 hours, preceding the scheduled time of feeding the reconstituted beverage i.e. administering the reconstituted beverage (the beverage being prepared in the method of the invention). The actual amount consumed is calculated from the amount of reconstituted

beverage offered for consumption and the amount of reconstituted beverage not being consumed. The amount offered and / or consumed may easily be determined by weighing the container using a scale. Alternatively, the container may be provided with a scale indicating the volume present in the container.

5

A computer may be used to calculate the EWL and / or the adjustment of ratio (40) as defined in the method of the invention.

In one aspect the invention relates to a computer program executable on a computer (100) for assisting in the preparation of a beverage, wherein the computer program is

10 configured to:

- a) store at least one personal subject profile comprising information related to an identified subject;
- b) store at least one set of preparation instructions for at least one formula product (10);
- 15 c) pair at least one formula product selected from a group consisting of one or more formula products (10.1, 10.2, 10.3, 10.4, ..., 10.x) with the stored subject profile;
- d) compute from the pairing of the formula product and stored subject profile, a coaching instruction set by determining preparation information, the coaching
- 20 instruction set comprising a desired amount of the formula product (10) and a desired amount of liquid (30);

wherein the adjusted ratio (40) between the desired amount of the formula product (10) and the desired amount of liquid (30) is determined using the method of the invention.

25

In another aspect, the invention relates to a computer (100) executing the computer program of the invention wherein in one embodiment, the computer (100) executing the computer program of the invention is using an electronic device (200) arranged in communication with the computer, wherein the preparation information is enabling

30 the control of operations of the electronic device (200) for the preparation of an individual subject beverage and intended to be communicated to or be generated by the scale for enabling the scale to control such operations.

Optionally, the computer program is configured to determine the desired amount of liquid (30) and the desired amount of formula (10) for enabling the device to control the weighing of such amounts. Preferable the electronic device is an electronic scale.

- 5 Alternatively, in another embodiment, the computer (100) executing the computer program of the invention is further configured to provide data entry means (120) accessible to the user for acquiring information on the subject profile. The subject profile may contain data relating to the subject such as one or more selected from the group consisting of the subject name, subject date of birth and/or age, gender,
- 10 subject image, subject weight at one or more dates, allergy information, record of feeding times, record of feeding amounts offered, record of feeding consumed, formula product used by subject, and formula product (10) in current use by subject. The subject information may be used by the program to pair a subject to a specific formula product (10.1, 10.2, 10.3, 10.4, ..., 10.x). Likewise standard preparation
- 15 instructions may be stored for each formula product (10.x) such as designated age group, number of administrations per day, quantity of formula product per administration and standard amount of liquid (water) per 100g of formula product.

- In still another embodiment, the computer (100) executing the computer program of
- 20 the invention is further configured to provide at least one control interface (142, 143) adapted for retrieving, e.g. by scanning a code such as a bar code or QR code, product identification data associated to the formula product (10) for identification or authentication of formula product to enable the pairing with the subject profile. In this way a person preparing the reconstituted beverage is guided in selecting the right
- 25 formula product i.e. the formula product currently associated with the subject. The person preparing the reconstituted beverage may for instance select a subject and use the control interface (142, 143) to scan a product code of the formula product that is going to be used. The computer program will then check if the product code of the formula product that is going to be used is matching the formula product recorded
- 30 as the formula product currently in use by the subject. In case the two products are not the same, the computer program will generate a warning which is shown the person preparing the reconstituted beverage. Alternatively, the electronic scale (200) which may be used can be blocked by the computer program, optionally a warning signal may be shown in the scale (200).

In yet another embodiment, the computer program of the invention is configured to compute and display on the computer's user interface, preparation information such as the individual and/or cumulated weighed quantities of infant formula administered per time period (e.g. per day) optionally in the form of a feeding history. A feeding history being an overview of the amounts of reconstituted beverage or formula product being prepared (and optionally being consumed) over a period of time. Different types of information may be displayed in graphs, tables, bars or other graphics.

10 In one embodiment the computer program according to the invention is configured to communicate wireless to the electronic scale, preferably using Bluetooth or Wi-Fi.

The computer program according to the invention may be hosted on any type of computer. As most formula products are prepared at home, the computer program of the invention is preferably configured to be hosted by an in-home computer, a tablet or a smart phone. Hosting on a smart phone being preferred as such a device is generally available and helps to keep the solution non-expensive.

20 It may be that a reconstituted beverage for a subject is prepared from two or more formula product. Hence, in another embodiment, in step c) of the computer program of the invention at least two formula products are selected from a group consisting of two or more formula products (10.1, 10.2, 10.3, 10.4, ..., 10.x) with the stored subject profile.

25 When calculating the EWL the temperature, air humidity and air pressure may be needed as input. Hence in one embodiment the computer (100) in the computer of the invention is provided with air temperature determination means (130) for acquiring air temperature information on the location of the subject and which air temperature information is used to determine the EWL.

30 The air temperature determination means (130) may be a thermometer arranged in communication with the computer, or alternatively a control interface adapted for receiving the expected air temperature (such as a keyboard), or alternatively a control interface adapted for receiving the expected air temperature at the location of the subject from an external source (such as an online weather service).

In another embodiment, the computer (100) in the computer of the invention is provided with air humidity determination means (140) for acquiring air humidity information on the location of the subject and which air humidity information is used
5 to determine the EWL of the subject.

The air humidity determination means (140) may be an air humidity measuring device arranged in communication with the computer, or alternatively a control interface adapted for receiving the expected air humidity (such as a keyboard), or alternatively a control interface adapted for receiving the expected air humidity at the location of
10 the subject from an external source (such as an online weather service).

In yet another embodiment, the computer (100) in the computer of the invention is provided with air pressure determination means (not shown) for acquiring air pressure information on the location of the subject and which air pressure information is used to determine the EWL of the subject.

15 The air pressure determination means (not shown) may be an air pressure measuring device arranged in communication with the computer, or alternatively a control interface adapted for receiving the expected air pressure (such as a keyboard), or alternatively a control interface adapted for receiving the expected air pressure at the location of the subject from an external source (such as an online
20 weather service).

Preferably, the computer (100) in the computer of the invention is provided with air temperature determination means (130), with air humidity determination means (140) and with air pressure determination means wherein the air temperature determination
25 means (130) are for acquiring air temperature information on the location of the subject, the air humidity determination means (140) are for acquiring air humidity information on the location of the subject and the air pressure means are for acquiring air pressure information on the location of the subject; and the air temperature together with the air humidity and air pressure on the location of the
30 subject are used to determine the EWL.

In yet another aspect the invention relates to an electronic device (200), preferably a scale, for assisting in the preparation of a reconstituted beverage in a feeding container (20) wherein the device is comprising a weighing unit (208) with a user

interface (203), a control unit (215) and a communication module (216) arranged to communicate with a computer (100) hosting the computer program according to the invention wherein the device comprises a coaching program (CP) configured for selecting a subject profile and controlling operations of the formula preparation

5 according to

- i) the coaching instruction set received from the computer device resulting from the pairing of the selected subject profile and an formula product selected from a plurality of infant formula products (10.1, 10.2, 10.3, 10.4, ..., 10.x); and
- ii) the EWL of the subject.

10

In one embodiment, the electronic device (200) according to the invention is arranged for weighing and controlling the liquid (30) quantity and formula product (10) quantity to match respectively a liquid (30) set point and a formula (10) set point during preparation. Preferably, the electronic device (200) according to the invention

15 is further arranged for recording the weighed reconstituted beverage quantity.

In another embodiment, the electronic device according to the invention is arranged for weighing the quantity of remaining (non-consumed) reconstituted beverage and for communicating it to the computer. Preferably comparing such quantity to a

20 recommended reconstituted beverage and/or to the weighed reconstituted beverage quantity recorded from the preparation is done by the computer program running on the computer (100).

In still another embodiment, the electronic device according to the invention is

25 arranged for displaying on its user interface (203) information related to the ongoing preparation and/ or next preparation(s). Information relating to the ongoing preparation may for example include the amount of liquid and formula product that has been measured; or needs to be measured, the name of the subject and a time for administration. Information relating to next preparation(s) may additionally include

30 information about adjustments to the amount of formula product (10), liquid (30) and to ratio (40) based on the EWL or expected EWL of the subject.

Optionally the electronic device according to the invention is arranged for displaying on the user interface (203) the liquid (30) weighing and the formula product (10)

weighing in real time such as under the form of progression bars and preferably for providing a visual and/or sound signal when the weighed liquid (30) quantity and formula product (10) quantity have matched the respective set points.

- 5 The electronic device according to the invention may further comprise a temperature sensing unit (209) for sensing the liquid temperature in the container; such temperature sensing unit being connected to the weighing unit (208) for communicating the temperature of the liquid and/or reconstituted beverage and optionally, the weighing unit (208) is configured for interrupting the coaching program
- 10 (CP) if the sensed temperature deviates from a temperature set point. Normally, the temperature set point will be such that it prevents preparation of reconstituted beverages which are too hot for consumption e.g. warmer than 37°C. A second temperature set point may be used to prevent preparation of reconstituted beverages which are too cold for consumption or for dissolving the formula product. Such
- 15 second temperature set point may be set 20°C or below, preferably at 25°C or below, more preferably at 30°C or below.

- Further, the electronic device according to another embodiment of the device of the invention comprises an air temperature sensing unit (219) for sensing the air
- 20 temperature in the direct vicinity of the electronic device; such temperature sensing unit being connected to the communication module (216) for communicating the air temperature to the computer (100) such that the computer program of the invention may use this air temperature for calculating the EWL of the subject; changes in the expected EWL status may be communicated back to the electronic device and result
- 25 in an adjustment of the coaching program (CP).

- Alternatively, the electronic device according to an embodiment of the device of the invention comprises an air temperature sensing unit (219) for sensing the air temperature in the direct vicinity of the electronic device, such temperature sensing unit being connected to the communication module (216) for communicating the air
- 30 temperature to the computer (100), the computer (100) being configured for offering an adjustment of the coaching program (CP) if the sensed air temperature deviates from a temperature set point; e.g. in one embodiment an increase in the relative amount of liquid as compared to the amount of formula product if the temperature is above 25°C.

In still another embodiment, the electronic device according to another embodiment of the device of the invention comprises an air humidity sensing unit (249) for sensing the relative air humidity in the direct vicinity of the electronic device; such humidity sensing unit being connected to the communication module (216) for communicating the relative air humidity to the computer (100) such that the computer program of the invention may use this relative air humidity for calculating the EWL of the subject; changes in the EWL status may be communicated back to the electronic device and result in an adjustment of the coaching program (CP).

Alternatively, the electronic device according to an embodiment of the device of the invention comprises an air humidity sensing unit (249) for sensing the relative air humidity in the direct vicinity of the electronic device; such humidity sensing unit being connected to the communication module (216) for communicating the relative air humidity to the computer (100) such that the computer (100) is configured for offering an adjustment of the coaching program (CP) if the sensed relative air humidity deviates from a relative air humidity set point; e.g. in one embodiment an increase in the relative amount of liquid if the relative air humidity is above 60%, such as above 70%, 80% or preferably above 85%. Likewise, in another embodiment the electronic device comprises an air pressure sensing unit for sensing the air pressure in the direct vicinity of the electronic device.

20

In still another aspect the invention relates to a system for assisting in the preparation of a beverage (e.g. a reconstituted beverage) comprising a computer program according to the invention and hosted on a computer and an electronic device (200) according to the invention, the device being arranged to communicate with the computer and being arranged for controlling operations of the formula preparation according to the received coaching instruction set communicated by the computer device.

In a preferred embodiment of the aspects of the invention the formula product (10) is an infant formula product, and the subject is an infant aged 0-36 months, and the liquid (30) is water, more preferably boiled water.

In another preferred embodiment of the aspects of the invention the formula product (10) is an infant formula product, and the subject is an infant aged 0-36 months, and

the electronic device (200) is an electronic scale and the liquid (30) is water, more preferably boiled water.

In yet another preferred embodiment of the aspects of the invention the formula product (10) is an infant formula product, and the subject is an infant aged 0-36 months, and the electronic device (200) is an electronic scale, and the computer program is configured to be hosted on a smart-phone, and the liquid (30) is water, more preferably boiled water.

10 **Brief description of the drawings**

Figure 1 shows a computer -assisted system for assisting the preparation of formula product according to the invention;

Figure 2 relates to a flow chart for a coaching program for controlling the preparation of the reconstituted beverage on the electronic 200 taking into account the EWL of the subject.

Detailed description of the drawings

The computer-assisted system 1 of the invention is illustrated in Figure 1. It commonly comprises a dedicated electronic device such as a scale 200, preferably an electronic scale, comprising a user interface 213 and an executable program hosted in a computer 100. The computer is connected to a communication network 105, generally linked to a remote resource such as a server 106. The computer comprises, as known per se, a user interface, a processor and memories, means for inputting data and a communication module. In particular, the computer may be a smart phone, a tablet or an in-home computer accessible to the user in charge of preparing the formula.

The system further comprises a plurality of formula products 10.1, 10.2, 10.3, 10.4, ..., 10,x with ID1, ID2, ID3, ID4,..., IDx, respectively. The products may be for example a range of packaged infant formula compositions corresponding to different stages of the growth of the infant or be related to particular nutritional or therapeutic diets. The formula products may be stored in product packages such as cans, pouches, cartridges and the like. Each kind of formula product may be associated to product identification data (ID1, ID2, ID3, ID4, ..., IDx).

The product identification data may comprise: a product type (10.1, 10.2, 10.3, 10.4, ..., 10,x), a unique identification numeric or alphanumeric number (e.g. serial number), an expiry date, a brand or name, product plant, general preparation data, and combinations thereof. The product identification data can usually be used for
5 determining the type of product the formula product belongs to and for safety, logistic and traceability purposes.

The product identification data is preferably coded in an optical code such as a 1-D or 2-D barcode such a QR code and the like. This information of the code can be retrieved by the computer such as by scanning with a camera and image processing
10 means that can be part of the computer itself or be connected thereto. The product identification data can be stored in the memory of the computer and be used for preparing the reconstituted beverage by carrying out initial functions such as the identification and pairing of the infant formula product to a subject profile.

A particular program of the invention (which may also be referred to as application or
15 "App") is configured to execute instructions in the computer to carry out these functions.

The electronic device 200, preferably an electronic scale, is preferably connected to the computer wirelessly such as by Bluetooth, Wi-Fi or equivalent. The
20 communication between the application ("App") of the computer and the device can be carried out automatically such as by light pairing. The communication is configured to be bi-directional thereby enabling data to be communicated from the computer to the scale such as preparation instructions and data to be communicated from the scale to the computer such as feedback information like weight-related,
25 time-related, air humidity related, air temperature related and/or liquid temperature information.

The electronic device may determine the weight of the feeding container (20). Liquid from an external source, such as tap water, may be poured into the container (20).
30 The amount of liquid may be determined by weighing the container (20) filled with liquid. Likewise, the amount of formula product (10) may be determined using the device (200). The ratio (40) between the amount of formula product (10) and liquid (30) may be calculated by the device (200) or the computer (100) (the ratio is not shown in Figure 1).

A program hosted in the computer (100) may be configured for sending a coaching instruction set to the device (200). In a first operation step (S1), the program is configured for acquiring information from the formula product such as by scanning a code. An optional check on the authorization of the formula product may be carried
5 out by the program to ensure the safety compliance of the product. The program may be ended if the formula product is identified as undesirable. Data may also be transmitted (downloaded) from the server to the computer after product identification is completed. For instance, data may relate to product information updates such as nutritional facts, recommendations or messages for the user.

10 In another operation, the program is configured for selecting the formula product as function of relevant information in the subject profile such as his/her age and pair them (Pairing formula product to subject; Step 2[S2]). Other kinds of information may be taken into account that can be personalized to the subject to be fed such as a particular allergy or therapeutic reason or diet. If pairing is unsuccessful in this
15 operation S2, for example because the scanned formula product is not adapted to the infant profile, the program may be ended and/or a corresponding message displayed. If pairing is successful, the program may record the identified infant formula product in the infant profile.

As a result of such pairing, the program is allowed to determine the selected or
20 recorded infant formula product, the coaching instruction set in particular the weighing set points based on the EWL of the subject to control the preparation of the formula product with the device 200 (Coaching instruction set Step 3 [S3]). The set points form a coaching instruction set which is addressed by the computer to the device 200. These set points are specific to each formula product and the hEWL of
25 the subject. The setpoints can be: the weight of liquid (preferably water) and the weight of formula product. They are usually determined as function of information in the subject profile which is relevant to the preparation of the formula product, e.g. weight and/or size of the infant. This information is combined with the EWL or expected EWL of the subject. The expected EWL may be determined using one or
30 more of the input parameters as defined in the method of the invention. Therefore, the computer generally stores such information enabling such determination by the program. In the simplest possible form, for each subject such information can be the desired / linked formula product, a set of standard preparation instructions for the

product, the subject age, the EWL, and the relevant weight set points for the device 200.

Finally, the set of coaching instructions containing such set points are transferred from the computer to the device 200 for execution of a corresponding program by the
5 device (Step 4 [S4]).

In a possible variant, the determination of the set points could be executed by a program of the device 200 from information related to the formula product and to subject profile transferred by the computer 100 to the device 200. However, this
10 variant is less preferred as it requires a more complex control unit with more processing power and a larger memory in the scale.

The communication between the computer 100 and the remote server 106 via the communication network 105 is also preferably established bi-directionally to allow
15 exchange of information. In particular, the communication from the server to the computer can be carried out for updating the program of the invention in the computer, for sending product identification data or notifications such as nutritional recommendations, safety messages or promotional offers. The communication from the computer to the server can also be carried out for tracking information, sending
20 program status, creating and updating customer or nutritional data bases, for accessing to websites, shopping, etc.

The electronic device 200 of the invention, preferably is an electronic scale. The device comprises a weighing unit and an optional temperature sensing unit for
25 sensing the temperature of the liquid or reconstituted beverage. The device further optionally comprises an air temperature sensing unit, an air pressure sensing unit and an air humidity sensing unit. The weighing unit is configured to provide preparation instructions, subject profile information or other types of information to the user via the user interface 213 comprising a screen (e.g. LED display, E-ink
30 paper) and a user selection buttons such as to select and validate choices and/or navigate through different menus displayed on the screen. The scale is able to measure the liquid quantity filled in the feeding container 20 as well as the formula product quantity filled in the container when added to the liquid. The scale comprises at least one weight sensor that provides weight-related input to a control unit (e.g. a

main PCB). A communication module such as a bi-directional wireless module (e.g. Wi-Fi or Bluetooth) may also be connected to the control unit for the exchange of data (coaching instructions, consumption data, program updates, etc.) with the computer 100. A connectivity button, e.g. an on/off button with light e.g. LED,
5 connectivity feedback may be further provided. An electrical supply location for a rechargeable energy accumulator or an exchangeable battery, is provided to supply the different electronic components with low voltage current.

The temperature sensing unit can be connected to the device 200 to be able to communicate information as to the sensed temperature of the liquid in the feeding
10 container 20 (e.g. baby bottle). The temperature sensing unit may comprise a contactless sensor such as an infrared temperature sensor for sensing the temperature of the liquid in the feeding container without contact so reducing the risk of contamination. The unit preferably forms a lid that may cover and protect the weighing support of the weighing unit. The temperature sensing unit comprises a
15 control unit (e.g. PCB) to receive temperature input. The connection may be obtained by a wireless communication module connected to the control unit for communicating temperature information to the device and/or to the computer. An electrical supply location for a rechargeable energy accumulator or an exchangeable battery is provided to autonomously supply the temperature sensor and control unit with low
20 voltage current. The sensor could also be a contact sensor such a thermocouple probe.

The air temperature sensing unit can be connected to the device 200 to be able to communicate information as to the sensed air temperature in the surrounding of the device 200, which often is similar to the temperature at the location where the subject
25 is residing. The temperature sensing unit may comprise a contactless sensor such as an infrared temperature sensor for sensing the air temperature. The temperature sensing unit comprises a control unit (e.g. PCB) to receive temperature input. The connection may be obtained by a wireless communication module connected to the control unit for communicating temperature information to the device and/or to the
30 computer. An electrical supply location for a rechargeable energy accumulator or an exchangeable battery is provided to autonomously supply the temperature sensor and control unit with low voltage current. The sensor could also be a contact sensor such a thermocouple probe.

The air humidity sensing unit can be connected to the device 200 to be able to communicate information as to the sensed air humidity in the surrounding of the device 200, which often is similar to the air humidity at the location where the subject is residing. The air humidity sensing unit may comprise a contactless sensor such as
5 a capacitive, resistive, or thermal sensor that monitors minute changes in the atmosphere in order to calculate the humidity in the air. The air humidity sensing unit comprises a control unit (e.g. PCB) to receive humidity input. The connection may be obtained by a wireless communication module connected to the control unit for communicating humidity information to the device and/or to the computer. An
10 electrical supply location for a rechargeable energy accumulator or an exchangeable battery is provided to autonomously supply the air humidity sensor and control unit with low voltage current.

The air pressure sensing unit can be connected to the device 200 to be able to communicate information as to the sensed air pressure in the surrounding of the
15 device 200, which often is similar to the air pressure at the location where the subject is residing. The air pressure sensing unit may comprise a contactless sensor such as a barometric pressure sensor that monitors minute changes in the atmosphere in order to calculate the pressure in the air. The air pressure sensing unit comprises a control unit (e.g. PCB) to receive air pressure input. The connection may be obtained
20 by a wireless communication module connected to the control unit for communicating humidity information to the device and/or to the computer. An electrical supply location for a rechargeable energy accumulator or an exchangeable battery is provided to autonomously supply the air pressure sensor and control unit with low voltage current.

25
Figure 2 illustrates the coaching program comprising the steps carried out by the device 200 under control of its control unit and user interface 213 during preparation of the reconstituted beverage. After the device 200 has started in step 1000, the device proposes the selection of a subject profile amongst a list of subject profiles in
30 step 2000. The request for selection of a subject may appear on the screen of the user interface. The displayed subject profiles are preferably stored in a memory of the control unit of the device so that preparation is enabled even when the communication between the computer and scale is interrupted. The list of profiles can be regularly updated from the computer to the device. It is also possible to

retrieve a new profile by requesting information from the computer in this operation. The validation of an existing subject profile, triggers the next operation of the procedure of the program.

- In step 3000, the subject profile is usually stored in the computer to enable each
- 5 profile to be paired with a particular formula product. The pairing is preferably carried out in the program executable by the computer but could also be carried out as instructions carried out by a program embedded in the control unit of the device 200. This next operation of the procedure involves the determination of the EWL of the subject selected. The EWL may be determined based on an information request sent
- 10 to the user concerning physical characteristics relating to the EWL such as input parameters as defined herein. Alternatively the expected EWL may be determined by the computer 100 or the device 200 based on the air temperature, the relative air humidity and other input parameters as defined elsewhere herein. The air temperature and relative humidity may also be provided by the user via the user
- 15 interface. The EWL or expected EWL is then determined by the computer program (app) running on the computer 100 or by the device 200. As a result of the pairing and EWL determination, coaching instructions (also called "a coaching instruction set" or "preparation instructions") are generated. The coaching instructions are preferably generated by the application stored in the computer 100 but, less
- 20 preferably, could also be generated by a program in the device 200. If the general coaching instructions sets are determined by the computer, each set is attributed to a particular subject profile. Once the choice for the subject profile is performed by the user on the user interface of the device and the general coaching instruction set is associated by the device to such profile, changes to the general coaching instruction
- 25 set (i.e. standard preparation instructions) based on the EWL are calculated and applied to the general coaching instructions, resulting in a "EWL-dependent coaching instruction set". This EWL-dependent coaching instruction set is enabling the device to operate the preparation according to the set matching the subject profile and subject EWL status.
- 30 The EWL-dependent coaching instruction set would typically comprise a liquid (preferably water) quantity set point and an formula product (preferably an infant formula) quantity set point for enabling the device to control the weighing of such quantities.

The coaching instruction set may further comprise instruction data amongst: a time related to the frequency or period of preparation of the formula product, a number of preparations per day, formula product information, EWL-based corrections being applied, and combinations thereof. For example, the control unit of the device may
5 receive information as the acceptable time range for the preparation and the control unit may operate a check to verify if the preparation operation is too early or too late or on time and can inform the user by a message, or disable the preparation procedure.

In the next operation 4000 of the scale's coaching program, the empty feeding
10 container 20 (e.g. baby bottle) weight is measured (i.e. tared). This operation can be optional but it ensures weighing accuracy when different infant containers are utilized. The instruction to place the empty feeding container on the device 200 and the indication that the taring operation is running may be displayed on the screen. A signal, e.g. a sound alert can be generated when the operation is completed.

15 In the next step 5000, liquid, preferably water, is poured into the feeding container 20 by the user (or by a dosing device) and the amount of liquid is weighed by the device 200. A request for filling the feeding container with the desired amount of liquid can be displayed on the interface and a visual indication on the progress of the water weighing operation is preferably displayed on the screen such as under the form of a
20 progression bar liquid weight set point is reached.

A next temperature sensing operation 6000 that may be optional or compulsory, may start at the condition of the preceding step being successfully completed. In this operation, the temperature sensing unit measures the liquid temperature e.g. by placing the infrared sensor above the liquid surface. The infrared sensor may be
25 electronically activated by means of a switch. A preferred arrangement of the switch can be a deformable annular ring-shaped switch which presents the advantage to be pressed or squeezed by hand on the side of the unit. The unit with the infrared sensor is configured to measure the temperature of liquid surface at a distance of a few centimeters. The temperature result may be displayed on the user interface of
30 the device 200 and/or on a user interface of the sensing unit. The temperature display may be a temperature point in scale or the like. The display may be followed by a validation step in which the user is requested to continue the preparation or it may automatically trigger the next operation. A check 7000 of the correct temperature can be performed and a warning signal 8000 be generated if the sensed

temperature does not match the temperature set point. If the sensed temperature is acceptable (e.g. corresponds to a temperature set point memorized in the scale), the next operation 9000 of the standard preparation procedure can take place.

In the next operation 9000, a request is displayed by the device to fill formula product
5 10 in the container. The weighing of the formula product (i.e. the cumulative weight of liquid and powder) is carried out by the scale in a same manner as for liquid. The weighing in step 9000 is preferably carried out in a continuous manner and preferably displayed on the screen such as under the form of a progression bar. When the measured weight reaches the formula set point, the operation is ended automatically
10 or upon a user's prompt and a visual and/or sound signal is generated. The conditions and/or time at which the preparation has been completed can be confirmed by the device to the computer and recorded in the computer and/or device to be used for historical feed tracking of the preparation.

The coaching procedure in the device may also be configured to be modified
15 manually by the user at the different steps of the preparation (e.g. increase or decrease of the water and/or infant formula set points). In such case, these modifications may also be transferred to the computer and recorded to ensure information tracking.

20 A consumption monitoring program carried out under the control of the electronic device 200 is described below. The procedure enables to determine the remaining (i.e. non-consumed) reconstituted beverage amount, to record it and to transfer this information to the computer 100. After the device 200 is in start mode, the consumption control procedure can be selected. A request for placing the feeding
25 container may be displayed by the user interface of the device (e.g. "Remaining milk"). In the next operation, the device is configured to measure the remaining reconstituted beverage weight when the feeding container is positioned on the scale of the device 200. An indication of the remaining quantity (e.g. such as a volume on a graduated scale) of reconstituted beverage may be displayed on the user interface. A
30 sound signal may be generated to indicate the end of the weighing step. The following operation may be to select the subject profile via a displayed message on the screen and to record the remaining reconstituted beverage quantity in relation to the selected subject profile. Alternatively, the order of subject selection and remaining reconstituted beverage determination may be changed.

The synchronization of the consumption information with the computer may be carried out immediately after it has been determined for a certain subject or be postponed if the communication is not established. In the last step, a visual and/or
5 sound signal can be generated by the scale to indicate the end of the procedure.

The computer program may be configured to automatically connect to the available electronic device 200 and/or may invite the user to select a scale which is placed within the connecting distance of the computer. The available devices can be
10 detected automatically and listed on a list of identified devices (e.g. by their name) allowing selection of an individually selected device for connection by the user, e.g. by simple click or touch. The connectivity to the device may also be bypassed by selecting a bypass command (e.g. "Ignore") to enable access for the user to application's functions which do not necessarily require the connection to the device
15 200 (e.g. inputting or consulting information, etc.).

A control interface may depict a menu for access to subject profiles (e.g. named "subject profiles"). The menu may present a list of subject profile summaries. The summaries may contain limited information such as main identification data (e.g.
20 photo, name, etc.) as well as essential coaching information for coaching the preparation of the next infant formula via the electronic device. For instance, the coaching information may include the infant formula powder name and next feeding time. The coaching information may be completed by intuitive pictograms that can easily inform the user on the type of instruction. An additional function may be
25 provided for each subject profile to add an subject feeding manually to the feeding history. Data entry means are provided related to personal infant profile information. The data entry means enable the information to be consulted, edited and modified by the user. The information may comprise, for example, the age, gender, size, weight of the subject. At least part of this information, for example, the age and/or weight,
30 will enable the program to properly pair a formula product 10 to the selected subject profile. The additional information may comprise the identification of formula product 10.x which is recommended for the preparation for the subject as function of the personal subject profile.

Coaching information may be provided such as the number of feedings per day.

A control interface can serve as guidance for retrieving the formula product 10 data information. The interface may provide specific instructions for retrieving information such as by scanning the code of the infant formula product. The application is
5 preferably configured for automatically capturing the information data from the code (e.g. QR code). The program may be further configured for assessing the proper adaptation of the retrieved product information with the subject profile information, e.g. age and/or weight of the subject such as in control interface. The program may run a safety check operation to ensure that the formula product is a product
10 authorized or adapted for subject consumption (e.g., recall product, expiry date passed, etc.). A message may be provided as to the proper adaptation and/or pairing of the formula product to the selected subject profile. The message may also mention that the product is not an authorized or adapted product. It should be noted that other ways may exist to retrieve information product in particular from the server via the
15 communication network. However, the retrieval of the product information from the product itself such as by scanning is preferred because it can give reassurance to the user that the available formula product is one adapted to the subject to be fed.

Other control interfaces can display information as to the feeding history for a
20 particular subject profile and/or for a particular time period. For instance, a daily consumption graph showing the formula consumption on a feeding volume and time basis. The total volume can be summed and compared to the daily planned consumption. As another example, a display of the consumption history over time which may include feeding statistical data showing for a given period (e.g. over 7
25 days) the difference between the planned formula quantities and the consumed quantities per each day (i.e. which are directly related to the remaining quantities of liquid measured by the device 200 after feeding as previously described in relation to the consumption control procedure). The planned formula quantities are preferably the theoretical recommended quantities calculated or extrapolated by the computer
30 program as a function of the paired subject profile and product information. Alternatively, the planned quantities can be the formula weighed during preparation by the device 200.

The user interface of the device of the invention is very intuitive and enables the user to prepare the formula in the most accurate and safe manner.

Generally, certain requests require preparation-related steps such as placing the feeding container on the scale or filling the container with liquid or ingredient. Certain requests must be followed by a validation on a selection button to initiate the next step, e.g. to initiate a weighing operation by click or to validate the selection of a
5 subject profile by click. A weighing operation is generally displayed in real time by showing the weight increase such as by means of a progression bar (or a percentage or function). Certain operations are ended by a visual and/or sound signal. The nutritional coaching application may include additional functions such as online shopping or tracking of food input other than infant formula (such as fruit, meat, etc.).

10

It is to be understood that this invention is not limited to the specific embodiments and methods described herein, as specific components and/or conditions may, of course, vary. Furthermore, the terminology used herein is used only for the purpose of describing particular embodiments of the present invention and is not intended to
15 be limiting in any way.

It must also be noted that, as used in the specification and the appended claims, the singular form "a", "an," and "the" comprise plural referents unless the context clearly indicates otherwise. For example, reference to a component in the singular is intended to comprise a plurality of components.

20 Unless defined otherwise, all technical and scientific terms used herein generally have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs.

Except in the examples, or where otherwise expressly indicated, all numerical quantities in this description indicating amounts of material or conditions of reaction and/or use are to be understood as modified by the word "about" in describing the
25 broadest scope of the invention. Practice within the numerical limits stated is generally preferred. Also, unless expressly stated to the contrary: percent, "parts of," and ratio values are by weight; the description of a group or class of materials as suitable or preferred for a given purpose in connection with the invention implies that
30 mixtures of any two or more of the members of the group or class are equally suitable or preferred; description of constituents in chemical terms refers to the constituents at the time of addition to any combination specified in the description, and does not necessarily preclude chemical interactions among the constituents of a mixture once mixed; the first definition of an acronym or other abbreviation applies to all

subsequent uses herein of the same abbreviation and applies, mutatis mutandis, to normal grammatical variations of the initially defined abbreviation; and, unless expressly stated to the contrary, measurement of a property is determined by the same technique as previously or later referenced for the same property.

5

Example

Formula Product 1 (FP1) is an infant formula with a default ratio (40) wherein FP1 needs to be mixed with a water, this ratio (40) is 15 grams of FP1 per 100 mL, which results in a ratio of $15/100 = 0.15$ g/mL.

- 10 The subject receiving FP1 weights 5.0 kg, and according to the manufacturer's instruction, the subject should receive 750 mL of formula product per day. Hence the daily amount of liquid (= Standard Water Loss (SWL)) is 750 mL and the daily amount of formula product FP1 is 112.5 g of FP1 (7.5×15).

- 15 The subject is living in a hot and humid area which results in the Total Water Loss (TWL) being equal to 820 mL per day i.e. the sum of RWL, UWL, FWL, TEWL, and SweatWL.

Based on the above, the Excess Water Loss (EWL) is calculated as $TWL - SWL = 820 - 750 = 70$ mL per day which is more than 0 mL/day.

- 20 The Increase in the daily amount of liquid ranging from 63 to 77 mL (i.e. $70 \text{ mL} - 10\%$ to $70 \text{ mL} + 10\%$).

Accordingly, the adjustment of ratio (40) is equal to 112.5 grams of FP1 per 813 to 827 mL {i.e. $750 + (63 \text{ to } 77 \text{ mL})$ } resulting in an adjusted ratio of 0.138 to 0.136 g/mL (i.e. $112.5 / 813$ to $112.5 / 827$).

- 25 As such the ratio (40) has decreased from 0.15 to an adjusted ratio of 0.138 to 0.136 g/mL which corresponds to 92.0% to 90.7% of the default ratio value.

Claims

1. Method for the preparation of a beverage, preferably an infant formula, for a subject from a formula product (10) comprising the steps of
 - 5 i. obtaining the formula product (10) with a default ratio (40) wherein the formula product (10) needs to be mixed with a liquid (30) and with a recommended daily intake of beverage and a corresponding "Daily amount of liquid" and "Daily amount of formula product";
 - 10 ii. determining the total water loss (TWL) of the subject using three or more of the Respiratory Water Loss (RWL), the Urinary Water Loss (UWL), the Fecal Water Loss (FWL), the Trans Epidermal Water Loss (TEWL), and Sweat Water Loss (SweatWL);
 - iii. calculate the Excess Water Loss (EWL) as $TWL - SWL$ for the subject,
 - iv. adjusting the default ratio (40) if EWL is larger than 0 mL/day;
- 15 wherein the adjustment of the ratio (40), i.e. "adjusted ratio", corresponds to an increase in the Daily amount of liquid with the EWL +/- 10% while keeping the Daily amount of formula product constant;
wherein the SWL (Standard Water Loss) is equal to the Daily amount of liquid.
- 20 2. Method according to claim 1 wherein the adjusted ratio is at least 3%; preferably at least 5%, more preferably at least 10 %, even more preferably at least 15% below the default ratio (40).
3. Method according to any one of the preceding claims, wherein the subject is a
25 human subject.
4. Method according to any one of the preceding claims wherein the liquid is water, preferably drinking water.
- 30 5. Method according to any of the preceding claims wherein the RWL is determined using the weight of the subject and the Air Pressure [mBar]; the UWL is determined by measuring the amount of urine produced per day by the subject,
the FWL is determined using the weight of the subject;

the TEWL is determined using the temperature, relative humidity [%], the age of the subject, and the weight of the subject; and
the SEWL is determined using the temperature and relative humidity [%].

5 6. Method according to any of the preceding claims wherein the EWL is more than 20 mL per day, preferably more than 40 mL per day, more preferably more than 60 mL per day, even more preferably more than 80 mL per day.

7. Method according to any one of the preceding claims, wherein the subject is a
10 human subject between 0 and 5 years old, preferably between 0 and 3 years old, more preferably between 0 and 12 months old.

8. Method according to any one of the preceding claims wherein the default ratio (40) between the desired amount of the infant formula product (10) and the desired
15 amount of liquid (30) additionally depends on other food the subject is consuming, preferably wherein the default ratio (40) is increased when the dry matter content in the other food is 30 wt% or lower; or alternatively preferably wherein default ratio (40) is increased when the dry matter content in the other food is 20wt% or lower.

20 9. Method according to any of the preceding claims wherein EWL as calculated in step iii. is increased with the amount of beverage not being consumed in the 24 hours preceding the scheduled time of feeding the beverage being prepared.

10. The method according to any of the preceding claims wherein the Excess
25 Water Loss (EWL) and/or the adjustment of ratio (40) is/are calculated using a computer.

11. A computer program executable on a computer (100) for assisting in the preparation of a beverage, wherein the computer program is configured to:
30 a) store at least one personal subject profile comprising information related to an identified subject;
b) store at least one set of preparation instructions for at least one formula product (10);

- c) pair at least one formula product selected from a group consisting of one or more formula products (10.1, 10.2, 10.3, 10.4, ..., 10.x) with the stored subject profile;
- d) compute from the pairing of the formula product and stored subject profile, a coaching instruction set by determining preparation information, the coaching instruction set comprising a desired amount of the formula product (10) and a desired amount of liquid (30);

wherein the adjusted ratio (40) between the desired amount of the formula product (10) and the desired amount of liquid (30) is determined using the method of anyone of claims 1 to 9.

12. A computer (100) executing the computer program of claim 11 wherein the computer (100) is using an electronic device (200) arranged in communication with the computer, wherein the preparation information is enabling the control of operations of the electronic device (200) for the preparation of an individual subject beverage and intended to be communicated to or be generated by the scale for enabling the scale to control such operations; preferably wherein the electronic device is an electronic scale.

13. The computer of claim 12 wherein the computer (100) is provided with air temperature determination means (130) for acquiring air temperature information on the location of the subject which air temperature information is used to determine the EWL.

14. The computer of anyone of claims 12 or 13 wherein the computer (100) is provided with air humidity determination means (140) for acquiring air humidity information on the location of the subject and which air humidity information is used to determine EWL and/or wherein the computer (100) is provided with air pressure determination means for acquiring air pressure information on the location of the subject and which air pressure information is used to determine EWL.

15. System for assisting in the preparation of a beverage, preferably a reconstituted beverage in a feeding container (20), the system comprising a computer program according to claim 11 and hosted on a computer according to

anyone of claims 12 to 14 and an electronic device (200), the device being arranged to communicate with the computer and being arranged for controlling operations of the formula preparation according to the received coaching instruction set communicated by the computer device wherein the electronic device (200) is

5 comprising a weighing unit with a user interface (213), a control unit and a communication module arranged to communicate with a computer (100) hosting the computer program according to any one of claims 11 to 13 wherein the device comprises a coaching program (CP) configured for selecting a subject profile and controlling operations of the formula preparation according to

10 i) the coaching instruction set received from the computer device resulting from the pairing of the selected subject profile and an formula product selected from a plurality of infant formula products (10.1, 10.2, 10.3, 10.4, ..., 10.x); and

ii) the EWL of the subject or the expected EWL of the subject;

preferably wherein the electronic device (200) is an electronic scale.