510(k) SUBSTANTIAL EQUIVALENCE DETERMINATION
DECISION SUMMARY
ASSAY ONLY TEMPLATE

A. 510(k) Number:

k170587

B. Purpose for Submission:

Modification to an existing device: change from prescription use only to over-the-counter use and change from urinalysis for ten analytes to urinalysis for one analyte only (ketone)

C. Measurand:

Ketones (urine)

D. Type of Test:

Qualitative and Semi-Quantitative

E. Applicant:

ACON Laboratories, Inc.

F. Proprietary and Established Names:

On Call Ketone Reagent Strips for Urinalysis

Healthy Me Ketone Reagent Strips for Urinalysis

G. Regulatory Information:

1. Regulation section:

   21 CFR § 862.1435, Ketones (nonquantitative) test system

2. Classification:

   Class I, meets the limitations of exemption per 21 CFR 862.9 (c)(9)

3. Product code:

   JIN, Nitroprusside, ketones (urinary, non-quantitative)

4. Panel:

   Clinical Chemistry (75)

H. Intended Use:

1. Intended use(s):

   See indications for use, below.

2. Indication(s) for use:

   The Healthy Me Ketone Reagent Strips for Urinalysis:

   The Healthy Me Ketone Reagent Strips for Urinalysis are intended for the qualitative and semi-quantitative detection of ketone (acetoacetic acid) in urine. The identification of ketones is used in the diagnosis of acidosis (a condition characterized by abnormally high acidity of body fluids) or ketosis (a condition characterized by increased production of ketone bodies such as acetone) and for monitoring patients on ketogenic diets.

   The Healthy Me Ketone Reagent strips are intended for over the counter use by lay people with diabetes and/or people on low carb diets at home to check for the ketones in urine. This product is not intended for the management of diabetes.

   The On Call Ketone Reagent Strips for Urinalysis:

   The On Call Ketone Reagent Strips for Urinalysis are intended for the qualitative and semi-quantitative detection of ketone (acetoacetic acid) in urine. The identification of ketones is used in the diagnosis of acidosis (a condition characterized by abnormally high acidity of body fluids) or ketosis (a condition characterized by increased production of ketone bodies such as acetone) and for monitoring patients on ketogenic diets.

   The On Call Ketone Reagent strips are intended for over the counter use by lay people with diabetes and/or people on low carb diets at home to check for the ketones in urine. This product is not intended for the management of diabetes.

3. Special conditions for use statement(s):

   For over-the-counter use; lay users can perform the test using the midstream technique or the dip and read technique.

4. Special instrument requirements:

   These strips are visually read only.

I. Device Description:

On Call Reagent Strips for Urinalysis and Healthy Me Ketone Reagent Strips for Urinalysis are identical (and differ only by the tradename) and consist of a plastic strip to which a reagent pad is affixed. The reagent pad reacts with the urine and provides a visible color reaction.

On Call Reagent Strips for Urinalysis and Healthy Me Ketone Reagent Strips for Urinalysis are packaged along with a drying agent in a canister bottle. Each strip is ready to use upon removal from the canister. The entire reagent strip is disposable. Results are obtained by direct comparison to the test strip with color blocks printed on the bottle label. No calculations or laboratory instruments are needed.

The devices are over-the-counter versions of a previously cleared professional device for urine ketones (k061559-ACON Urinalysis Reagent Strips). The strips are identical, except that the ACON Urinalysis Reagent Strips contained test pads to evaluate 10 analytes (including ketones), and the On Call Reagent Strips for Urinalysis and Healthy Me Ketone Reagent Strips for Urinalysis strips each contain a single reagent pad (to evaluate ketones).

J. Substantial Equivalence Information:

1. Predicate device name(s):

   Ketostix Reagent Strips for Urinalysis

2. Predicate 510(k) number(s):

   k801270

3. Comparison with predicate:

Similarities		
Item	Device	Predicate
Intended Use	For the detection of ketones in urine.	Same
Reagent	Sodium nitroprusside Buffer	Same
Intended specimen	Urine	Same
Methodology	Based on ketones reacting with nitroprusside and acetoacetic acid to produce a color change ranging from beige for negative results to a dark purple color for positive results.	Same

Differences		
Item	Device	Predicate
Intended use population	For over the counter use	For professionals and for over the counter use
Time Required to Read Strips	15 to 120 seconds	15 seconds

K. Standard/Guidance Document Referenced (if applicable):

Clinical and Laboratory Standards Institute (CLSI) GP16-A3 "Urinalysis; Approved Guideline - Third Edition"

L. Test Principle:

The On Call Reagent Strips for Urinalysis and Healthy Me Ketone Reagent Strips for Urinalysis are for the qualitative and semi-quantitative detection of ketones (acetoacetic acid) in urine. The On Call Reagent Strips for Urinalysis and Healthy Me Ketone Reagent Strips for Urinalysis are based on ketones reacting with nitroprusside and acetoacetic acid to produce a color change ranging from beige for negative results to a dark purple color for positive results. Ketones are normally not present in urine.

M. Performance Characteristics (if/when applicable):

The ketones pad of the On Call Reagent Strips for Urinalysis and Healthy Me Ketone Reagent Strips for Urinalysis are identical to the ketones pad in the ACON Urinalysis Reagent Strips evaluated in k061559 (see device description).

1. Analytical performance:

a. Precision/Reproducibility:

The ketones pad is identical to the ketones pad in the ACON Urinalysis Reagent Strips evaluated in k061559, therefore precision/reproducibility studies were not repeated.

b. Linearity/assay reportable range:

The ketones pad is identical to the ketones pad in the ACON Urinalysis Reagent Strips evaluated in k061559, therefore linearity studies were not repeated.

c. Traceability, Stability, Expected values (controls, calibrators, or methods):

The sponsor did not indicate any degree of traceability for their device.

The recommended storage temperature conditions and claims are unchanged and are the same stability claims described in k061559.

d. Detection limit:

The ketones pad is identical to the ketones pad in the ACON Urinalysis Reagent Strips evaluated in k061559, therefore sensitivity studies were not repeated.

e. Analytical specificity:

Interference study was performed according to CLSI guideline EP7-A2, "Interference Testing in Clinical Chemistry" to determine the effect of potential interfering substances commonly found in human urine on the strips. Pooled human urine was divided into three samples; a negative sample with no ketones, a sample spiked with lithium acetoacetate for a ketone concentration of 5 mg/dL, and a sample spiked with lithium acetoacetate for a ketone concentration of 160 mg/dL.

Potential interfering substances and target concentrations evaluated are shown below. Interferences were initially evaluated at concentrations listed; if interference was observed, serial dilutions of the substance were tested until no interference was observed:

Substance	**Concentration**
Human serum albumin	30000 mg/dL
Ascorbic acid	200 mg/dL
D-glucose	5000 mg/dL
Bilirubin conjugate	170 mg/dL
Hemoglobin	1000 mg/dL
Ammonium chloride	100 mg/dL
Calcium chloride	275 mg/dL
Citric acid	75 mg/dL
Creatinine hydrochloride	10 mg/dL
Creatinine	600 mg/dL
Fructose	100 mg/dL
Galactose	80 mg/dL
D-glucose	5000 mg/dL
Glycine	450 mg/dL
Lactose	10 mg/dL
Lithium acetoacetate	250 mg/dL
Potassium chloride	1500 mg/dL

Substance	Concentration
Sodium chloride	5500 mg/dL
Oxalic acid	70 mg/dL
Riboflavin	10 mg/dL
Sodium acetate	25 mg/dL
Sodium bicarbonate	1500 mg/dL
Sodium nitrite	10 mg/dL
Sodium nitrate	10 mg/dL
Sodium phosphate	500 mg/dL
Theophylline	100 mg/dL
Urea	4000 mg/dL
Uric acid	150 mg/dL
Blood	1%
Leukocyte	2500 cell/µL
Human Immunoglobulins	25 mg/dL

No interference was observed with potentially interfering substances at the concentrations listed (i.e., all results were an exact color block match to control solutions lacking interferents).

Blood at a concentration of 5% caused false positive results for the proposed device. Since blood concentration ≥ 1% may cause false positive results for the proposed device, the sponsor's labeling states that blood in urine can lead to false positive results.

The sponsor additionally evaluated the performance of the proposed device under different light sources (incandescent, fluorescent, sunlight, mercury vapor, and sodium vapor) and determined that these sources provided adequate lighting for use since the test results (of urine samples with ketone concentrations of 5, 15, 40, 80 and 160 mg/dL) were not impacted by the different lighting conditions evaluated.

The effect of pH and specific gravity was also evaluated. Five normal fresh urine samples were pooled and split into aliquots spiked to contain ketone concentrations of 0, 5, 15, 40, 80, and 160 mg/dL. To evaluate the effect on device performance, aliquots with pH of 4, 5, 6, 7, 8, and 9, as well as aliquots with specific gravities of 1.000, 1.005, 1.010, 1.015, 1.020, 1.025, 1.030, 1.035, and 1.040 were prepared. Five replicate measurements were taken of each sample concentration at each condition. For all specific gravity and pH conditions evaluated, results were an exact color block match with the spiked sample concentrations prior to pH or specific gravity adjustment. Neither

pH nor specific gravity were observed to impact device performance across the range of pH and specific gravity evaluated.

f. Assay cut-off:

Not applicable.

2. Comparison studies:

a. Method comparison with predicate device:

User performance study (midstream collection): method comparison with predicate device:

The study evaluated the performance of the proposed device when a layperson performs the test following the product's package insert.

The study also determined if the proposed device can be used correctly by laypersons, and if results obtained by laypersons are equivalent to results obtained by trained professional operators using the predicate device.

71 volunteers at two sites performed the test on their own midstream urine with the candidate device following the product's package insert. At the same time, volunteers also collected their urine in a urine collection cup. These samples were tested by trained professional operators using the predicate device. All volunteers also answered a demographic survey and questionnaire regarding the proposed device.

Three lots of the proposed device were used in the study.

User performance study results (misdstream):

		Results (mg/dL) of predicate by technician						
		Neg	5 mg/dL	15 mg/dL	40 mg/dL	80 mg/dL	160 mg/dL	Total
Results (mg/dL) using the candidate device by layperson	Neg	42	0	0	0	0	0	42
	5 mg/dL	0	21	0	0	0	0	21
	15 mg/dL	0	0	6	0	0	0	6
	40 mg/dL	0	0	0	2	0	0	2
	80 mg/dL	0	0	0	0	0	0	0
	160 mg/dL	0	0	0	0	0	0	0
	Total	42	21	6	2	0	0	71
Same block agreement		100%						
Agreement within ±1 block		100%						

Results show 100% exact agreement, as well as 100% agreement within one color block.

User performance study (dipped sample): method comparison with predicate device:

238 Volunteer participants were recruited across three sites. The study evaluated the performance of the proposed device when a layperson performs the test following the product's package insert.

The study also determined if the proposed device can be used correctly by laypersons, and if results obtained by laypersons are equivalent to results obtained by trained professional operators using the predicate device.

Each participant tested two blinded test control urine solutions (human urine spiked with ketones) with the proposed device. These solutions were also tested by trained technicians using the predicate device.

User Performance Study Results:

		Results (mg/dL) of predicate by technician						Total
		Neg	5 mg/dL	15 mg/dL	40 mg/dL	80 mg/dL	160 mg/dL	
Results (mg/dL) using the candidate device by layperson	Neg	60						60
	5 mg/dL		57					57
	15 mg/dL			55				55
	40 mg/dL			1	52			53
	80 mg/dL					60		60
	160 mg/dL					1	61	62
	Total	60	57	56	52	61	61	347
Same Block Agreement		60/60 (100%)	57/57 (100%)	55/56 (98.3%)	52/52 (100%)	60/61 (98.6%)	61/61 (100%)	(99.4%)
Agreement Within ±1 Block		60/60	57/57	56/56	52/52	61/61	61/61	(100%)

Results show 100% agreement within one color block.

Additional Usability Study:

An additional usability study was conducted with 100 subjects to evaluate if the lay users can perform the test and interpret results accurately using their own urine following the product's package insert. Users were provided a cup with which to collect their own urine sample and test with the proposed device. Collected urine was then given to a technician to evaluate with the predicate device.

		Results (mg/dL) of predicate by technician						
		Neg	5 mg/dL	15 mg/dL	40 mg/dL	80 mg/dL	160 mg/dL	Total
Results (mg/dL) using the candidate device by layperson	Neg	89	0	0	0	0	0	89
	5 mg/dL	0	11	0	0	0	0	11
	15 mg/dL	0	0	0	0	0	0	0
	40 mg/dL	0	0	0	0	0	0	0
	80 mg/dL	0	0	0	0	0	0	0
	160 mg/dL	0	0	0	0	0	0	0
	Total	89	11	0	0	0	0	100
Same block agreement		100%						
Agreement within ±1 block		100%						

Results show 100% exact agreement, as well as 100% agreement within one color block.

b. Matrix comparison:

Not applicable.

3. Clinical studies:

a. Clinical Sensitivity:

Not applicable.

b. Clinical specificity:

Not applicable.

c. Other clinical supportive data (when a. and b. are not applicable):

Not applicable.

4. Clinical cut-off:

Not applicable.

5. Expected values/Reference range:

The sponsor included the following information in the package insert:

Normal urine will not have any ketones present. If your results are positive, you should immediately consult your health care provider. A positive ketone level in urine is called ketonuria. This can occur in the following instances:

- When a person is on a very low carbohydrate diet
- When diabetes mellitus is out of control.
- As a result of fasting, dieting, starvation, eating disorders, high protein diets and isopropanol ingestion.
- Ketonuria may be noted in normal pregnancy.

N. Proposed Labeling:

The labeling is sufficient and it satisfies the requirements of 21 CFR Part 809.10.

Additionally, the sponsor performed a readability assessment which showed that the package insert had a Flech-Kincaid Grade Level Score of 7.9. A survey of the voluneers who participated in the lay user study indicated that over 90% of users described the overall instructions as clear and easy to undersand, and no users described the instructions as difficult to follow or understand.

O. Conclusion:

The submitted information in this premarket notification is complete and supports a substantial equivalence decision.